“SKIN DISORDERS IN DIABETES MELLITUS –

A CLINICOPATHOLOGICAL STUDY”

Dissertation Submitted in
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(BRANCH XX)

DEPARTMENT OF DERMATOLOGY

MADRAS MEDICAL COLLEGE

THE TAMILNADU DR. M.G.R. MEDICALUNIVERSITY, CHENNAI

MAY 2018

CERTIFICATE –I

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DECLARATION

The dissertation entitled "**SKIN DISORDERS IN DIABETES MELLITUS – A CLINICOPATHOLOGICAL STUDY"** is a bonafide work done by **Dr. DURGAVATHI C** at Department of Dermatology, Venereology and Leprosy, Madras Medical College, Chennai – 3, during the academic year 2016 – 2018 under the guidance of **Prof. Dr. V. SAMPATH M.D(Dermatology).,** Professor, Department of Dermatology, Madras Medical College, Chennai.

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CONTENTS

ABBREVIATIONS

HLA	Human Leukocyte Antigen
OGTT	Oral Glucose Tolerance Test
HbAIC	Glycosylated Haemoglobin
AGE	Advanced Glycation Products
ROS	Reactive Oxygen Species
DM	Diabetes Mellitus
IDDM	Insulin Dependant Diabetes Mellitus
NIDDM	Non-insulin Dependant Diabetes Mellitus
ESR	Erythrocyte Sedimentation Rate
NLD	Necrobiosis Lipoidica Diabeticorum
GA	Granuloma Annulare
FBS	Fasting Blood Sugar
PPBS	Postprandial Blood Sugar
KOH	Potassium Hydroxide
HPE	Histopathological Examination
MRSA	Methicillin Resistant Staphylococcus Areus

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder with inappropriate hyperglycemia due to either inadequate insulin secretion or combination of insulin resistance and inadequate insulin secretion to compensatecausing disturbances of carbohydrate, protein and fat metabolism. It is a major endocrine cause of morbidity and mortality all over the world. The incidence and prevalence is increasing globally and it has severe impact on health system.

Diabetes mellitus is the great clinical imitator with a wide range of signs and symptoms affecting all systems and every organ of the body. Skin is also frequently involved. Skin manifestations in diabetes are numerous and percentage varies from 30-71% indicating how common skin involved in diabetes.[1, 2]

Various factors involved in skin manifestations are abnormal carbohydrate metabolism, other altered metabolic pathways, atherosclerosis, microangiopathy, neuron degeneration, and impaired host mechanisms. Thus skin is affected by both acute metabolic derangements and the chronic degenerative complications. Though there is no clear correlation between skin lesions and the severity of the diabetes, there may be correlation between skin manifestations and extracutaneous diabetic complications like vasculopathy and neuropathy. Skin disorders can be the presenting symptom or first sign of diabetes, hence by recognizing those cutaneous features, the underlying diabetes can be diagnosed promptly at an early stage thereby making the prognosis better. They are also known to be marker for

the course of the diabetes.This study was to analyze the prevalence and pattern of skin disorders among diabetic patients in our region.

REVIEW OF LITERATURE

PREVALENCE AND INCIDENCE

According to International Diabetes Federation estimates, around 415 million people had DM in 2015 and this number is expected to rise to 642 million by 2040[3,4]. India is home to 69.1 million people with DM and is estimated to have the second highest number of cases of DM in the world after China in 2015. The prevalence of DM in India ranges from 5–17%, with higher levels found in the southern part of the country and in urban areas[3, 5]. Indians are also believed to have a greater degree of insulin resistance and a stronger genetic predisposition to diabetes[6]. There are several reviews of various skin disorders related to diabetes mellitus[7-13]

CLASSIFICATION[14]

Diabetes can be classified into the following general categories:

1. Type 1 DM: insulin dependent which is usually juvenile onset, associated with HLA DR3, DQB1*0201 and DR4 and diabetes-associated autoantibodies, and is prone to ketoacidosis.
2. Type 2 DM: generally non-insulin dependent and usually adult onset and associated with obesity.
3. Secondary diabetes: iatrogenic or associated with pancreatic, hormonal and genetic disease.
4. Gestational diabetes: associated with pregnancy.

CRITERIA FOR THE DIAGNOSIS OF DIABETES[14]

Fasting plasma glucose (FBS) ≥ 126 mg/dl (7.0mmol/L)

(or)

2h plasma glucose (PPBS) ≥ 200 mg/dl (11.1mmol/L) during an OGTT

(or)

HbA1C ≥ 6.5%

(or)

Classic diabetes symptoms + Random blood sugar (RBS) ≥ 200mg/dl (11.1mmol/L)

IMPORTANCE OF CUTANEOUS MANIFESTATIONS IN DIABETES MELLITUS[15]

1. Many cutaneous diseases precede the onset of diabetes mellitus.
2. Certain complications gives clue to current and past metabolic status.
3. Some are cutaneous markers for the diagnosis of diabetes mellitus[16].
4. Recognition of cutaneous markers may slow the disease progression and improve the overall prognosis by enabling early diagnosis and treatment[16]
5. Serious life threatening skin presentations can occur.
6. Minor skin infections potentiate major complications and serve as a key to

the prevention and treatment of complications.

7. Some skin manifestations reflect duration of diabetes.

THE CLASSIFICATION OF CUTANEOUS MANIFESTATIONS OF DIABETES MELLITUS[17]:

1. INFECTIONS –
    (i) Fungal like candidiasis, dermatophytosis, pityriasis versicolor (tinea versicolor), mucor mycosis.
    (ii) Bacterial like furunculosis, carbuncle, ecthyma, erythrasma, paronychia, erysipelas.
    (iii) Viral infections like herpes zoster, verucca.
2. VASCULAR DAMAGE – Leg ulcerations, wet gangrene of foot, erysipelas like erythema, diabetic dermopathy, Rubeosis diabeticorum, Calciphylaxis
3. NEUROLOGICAL DAMAGE – Charcot arthropathy, diabetic foot ulcer, neuropathy- sensory, autonomic, motor.
4. OBESITY AND HYPERLIPIDEMIA RELATED DISEASES – acanthosis nigricans, acrochordons, eruptive xanthomas.
5. GRANULOMATOUS DISORDERS – Necrobiosis lipoidica, granuloma annulare
6. STIFF SKIN AND JOINTS – cheiroarthropathy, finger pebbles and scleredema diabeticorum.

7. DISEASES ASSOCIATED WITH DIABETES MELLITUS – diabetic bullae, pruritus, Nephrogenic fibrosing dermopathy, yellow skin and nail, lichen planus, psoriasis, Perforating dermatoses like reactive perforating collagenosis, autoimmune diseases like addisons, hypothyroidism (pretibial myxedema), coeliac disease(dermatitis herpetiformis), vitiligo, alopecia areata, Genetic diseases like werner syndrome, lipoid proteinosis, autoimmune polyendocrinopathy syndrome, systemic diseases like acromegaly, Lipodystrophy, Cushing syndrome, Haemochromatosis etc..
8. TREATMENT RELATED SKIN MANIFESTATIONS – insulin lipodystrophy, allergic reactions to insulin and oral hypoglycemic drugs.

PATHOGENESIS OF SKIN DISORDERS IN DIABETES MELLITUS[18]

Pathophysiology of skin disorders in diabetes is poorly understood[19]. Skin disorders in diabetes is caused by either diabetes induced metabolic changes in skin or by associated complications like vasculopathy and neuropathy. Diabetic complications are caused by direct damage caused by hyperglycemia and also by hyperglycemia induced non-enzymatic glycosylation of structural and regulatory proteins, lipids and nucleic acids. This causes accumulation of advanced glycosylation products (AGE)[20].

Specific receptors are present in many cell surfaces for the AGE. This initiates the different intracellular signaling cascade that can cause the diabetic complications. This AGE causes inhibition of keratinocyte proliferation and

migration, protein biosynthesis, inducing endothelial cell apoptosis, decreasing nitric oxide synthesis and impairing phagocytosis and chemo-taxis from several cells[18, 20].Also AGE act in several ways, causing reactive oxygen species (ROS) formation, impairing ROS clearance, as well as intra and extracellular proteins dysfunction thus inducing pro inflammatory cytokines through nuclear factor κβ (NF-κβ) pathway[21].They alters collagen properties by decreasing flexibility and solubility and increasing its rigidity[22]. Also, AGEs plays a major role in the development of fibrosis in DM[23], in skin aging[21] and in diabetes-related immunosuppression[24]. This Diabetes-related immunosuppression affects skin wound healing by leukocyte impaired function and malfunction of growth factors[25].

Bertheim et al. showed that diabetic patients with severe joint mobility on the hands had an increased epidermal thickness, with abnormal hyaluronic acid distribution on skin layers[26].

Due to altered action of insulin on keratinocyte proliferation, differentiation and migration it causes impaired epidermal barrier function and delayed wound healing[27-29].Also skin surface pH in intertriginous regions of diabetics is significantly elevated compared to non-diabetic patients[30]. In additional normal stratum corneum hydration, reduced sebaceous gland activity and altered skin elasticity is noted[31].

CUTANEOUS INFECTIONS IN DIABETES MELLITUS:

Infections can be the presenting sign and symptom of diabetes especially in type 2. Diabetics are said to be more prone for infection because of its influence on various factors[32] as follows:

(1) Immunological defect (local and systemic):

- Chemo-taxis, phagocytosis, migration and intracellular killingof the polymorphonuclear leucocytes are greatly reduced in diabetics when compared to others.
- Phagocytic ability of polymorphs are reduced when plasma glucose level > 250mg/dl.
- Lymphocyte transformation in response to mitogen phytohaemagglutinin was diminished in diabetic patients.

(2) Non-immunological factors:

- Level of glucose control: Candida albicans infection has direct correlation to the concentration of glucose especially in the saliva.
- Peripheral vascular disease common in diabetics increases the risk of infections.
- Also macro-vascular and micro-vascular dysfunction results in compromised local circulation leading to delayed response to infection and impaired wound healing.

- Sensory neuropathy makes the patient unaware of trauma, causing inadequate attention and more prone for secondary infection.
- Xerosis of the skin also predisposes to skin infection.

1) FUNGAL INFECTIONS

A) Candidal infections

Candida of the mucosa, nail folds, flexures, genitalia are more common in poorly controlled diabetes. It can cause angular cheilitis, oral thrush, vulvo-vaginitis, balanoposthitis, intertrigo, paronychia and onychomycosis. They may be the only presenting feature of Diabetes mellitus. Many physicians believe that diabetes increases the risk of candida vulvovaginitis[33]. Hyperglycemia promotes yeast adhesion and decreases its phagocytosis[34]. The ratio of epidermal glucose to blood glucose is higher in diabetics, an environment that is more favourable for the yeast and fungal growth[35]. The saliva of diabetic patient is shown to produce candida growth in vivo in a study[36] and they are more prone for oral candidiasis.

Oral Mucosal candidiasis[19]

Various forms of oral mucosal candidiasis include thrush (curdy white plaques over oral mucosa),atrophic candidiasis that manifests as bright red atrophy of the hard palate or tongue and angular cheilitis(perlèche), which presents as

erosions along labial commissures. Antifungal creams usually are required to eradicate the infection. Oral fluconazole tablets can be also given.

Candidal paronychia

9.8% of the diabetic women have paronychia compared to 3.4% in non-diabetics females[37]. Patient who immerse their hand frequently in water are more prone to this condition[38]. Typically begins with erythema, swelling, and pain at the lateral nail fold then leads to separation of lateral nail fold from the nail margin and later cuticle is lost[15]. Purulent drainage may be seen in candidal paronychia. This is typically characterized by intermittent exacerbations that may result in a nail plate dystrophy. Treatment includes keeping the hands as dry as possible, wearing of cotton gloves under rubber or vinyl gloves during dish washing. Topical antifungal solutions usually are adequate for treatment; however refractory cases may require oral therapy with an imidazole like fluconazole.

Candidal intertrigo

Candidal intertrigo particularly erosio interdigitalis blastomycetica is common in diabetics in between the third and fourth finger.

Vulvovaginal candidiasis

This is characterized by pruritus, vulval erythema, fissuring and rarely pustules. Severity of pruritus is directly proportional to the degree of glycosuria and hyperglycemia [39].Use of contraceptive pills, broad spectrum antibiotics and

steroids increases the risk many fold. Non-candida albicans are recognized more now in diabetics which are resistant to conventional antifungals.[39] Oral nystatin reduces the reservoir of candida in gastrointestinal tract.

Candidal balanitis[19]

It can presents as diffuse or focal erythema of the glans penis, erosions, pustules with pain and pruritus. Middle aged to elderly men with balanitis and phimosis should be evaluated for diabetes[40]. Topical or oral imidazole are the treatment of choice. Circumcision can be considered in refactory and recurrent cases.

B) Dermatophyte infections

Tinea pedis (athlete's foot) is more prevalent in diabetes than in the general population[41]. So the web spaces becomes scaly, itchy, macerated even vesicles and pustules can occur. Breaks in the normal skin barrier due to tinea may lead to erysipelas and cellulitis, and, ultimately, even to sepsis. Thus Tinea pedis should be promptly and aggressively treated in patients with diabetes mellitus [41]. Oral azoles like fluconazole, Itraconazole or Allylamine like Terbinafine is given after monitoring blood counts, liver function tests and other drug interactions. Preventive foot care, including drying, wearing of cotton socks and sandals may help prevent infection.

Tinea corporis and Tinea cruris are common clinical types. Trichophyton rubrum was the commonest isolate followed by Trichophyton mentagrophytes[42]

C) Mucor mycosis

Mucormycosis (also known as Zygomycosis or Phycomycosis) is usually caused by the fungal species Mucor or Rhizopus which are found in decaying vegetations and food with high sugar content[43]. As the macrophages from patients with diabetes have decreased ability to attach to the hyphae of the fungus this impairs immune responses directed against this microorganism[44]. Rhinocerebral mucor mycosis is the most common and fulminating type of Zygomycosis which is invariably associated Diabetes mellitus. It presents as brownish, blood stained nasal discharge, black eschar covered ulcer on the palate, fixed and dilated pupil, proptosis, ptosis and complete ophthalmoplegia[45]. As the fungus can produce angiocentric infection it can cause thrombosis of the cavernous sinus and meningo-encephalitis. It is invariably fatal if not treated early by surgical debridement, correction of electrolyte imbalance and intravenous amphotericin-B. These phycomycetes may complicate the long standing leg ulcers in diabetics.

D) Pityriasis versicolor

Extensive Pityriasisversicolor are commonly seen in diabetes mellitus people [46]

2) BACTERIAL INFECTIONS

A) Primary bacterial infections

Primary bacterial infections due to group A Streptococcus hemolyticus and Staphylococcus aureus are common in diabetic patients. Staphylococci colonize more in the lower extremity of patients with vasculopathy and neuropathy causing increased incidence of post operative infections than in non-diabetics[47]. Careful foot care and early treatment of dermatophytosis are essential in minimizing potential bacterial portals of entry. Furunculosis, carbuncle, cellulitis, erysipelas are much more common[15]. Diabetic patients are more likely to have methicillin-resistant Staphylococcus aureus (MRSA) and MRSA- induced bullous erysipelas[43]

B) Corynebacterial infections

Erythrasma is a bacterial infection of the skin caused by Corynebacterium minutissimum characterised by well defined reddish brown scaly patches with irregular border. It involves intertriginous areas of the groin, axilla and toe webs. 61% of diabetics are carriers of diptheroids and are associated with obesity.[48]

Pitted keratolysis caused by Corynebacterium and other bacterias such as Dermatophilus congolensis, Kytococcus sedentarius are found to be common in diabetic people.

Trichomycosis axillaris caused by Corynebacterium tenuis more common in diabetics in hot and humid environment.

C) Necrotizing fasciitis

It is a life threatening poly-microbial infection caused by Group A streptococci,Enterococci, Staphylococcus aureus, E.coli and various anaerobes[19]. The perineum, trunk,extremities especially legs and abdomen are the most commonly involved sites. Patients are severely toxic and presents with erythema, swelling, induration, necrosis and bullae formation.[49]

D) Malignant otitis externa

A severe necrotizing bacterial infection usually due to Pseudomonas aeruginosa mainly affecting middle aged diabetics[50]. It causes severe ear pain, pus discharge and cranial nerve palsies and later spreads to adjacent soft tissue, cartilage, and bone. Extended therapy with anti-pseudomonal agents and surgical debridement are required.[51]

3) VIRAL INFECTIONS

There is increased risk of herpes zoster secondary to Varicella reactivation as cell mediated immunity decreases in diabetes people. There is also reports of disseminated cutaneous herpes zoster in patients with uncontrolled diabetes.

MANIFESTATIONS DUE TO VASCULAR DAMAGE

PATHOPYSIOLOGY

Hyperglycemia causing accumulation of advanced glycation end products[18]. AGE act in several ways, causing reactive oxygen species (ROS) formation, impairing ROS clearance, as well as intra and extracellular proteins dysfunction thus inducing pro inflammatory cytokine through nuclear factor κβ (NF-κβ) pathway.[52]

1) MICRO AND MACROANGIOPATHY

Microangiopathy[17] is responsible for diabetic, retinopathy, nephropathy, neuropathy and dermopathy whereas large vessel disease or macroangiopathy manifests as atherosclerosis causing peripheral vascular disease, cerebro-vascular disease and ischemic heart disease. Cutaneous signs of microangiopathy are erysipelas like erythema, wet gangrene of the foot, diabetic rubeosis, diabetic dermopathy, periungual telangiectasia and nail changes[8]

2) LEG ULCERATION [53]

It is a complication whose cause is multifactorial. Neuropathy (motor, sensory and autonomic) and microangiopathy are the factors, among which the neuropathy being the major factor. Lack of sensation makes the trauma to go unnoticed this may result in ulceration that is complicated by the defective microcirculation. Prolonged pressure on the subcutaneous tissue causes ischemic

fat necrosis due to vascular compromise and too much force exerted for a work out of proportion leads to 'Mal perforans'. Risk factors for foot ulceration are duration, poor control of HbA1c level and peripheral neuropathy.[54] A painless and slowly penetrating ulcer of the sole and of other pressure sites which is circular and punched out in shape, occurs in the middle of a callosity. The multidisciplinary approach including endocrinologist, neurologist, orthopedic surgeon, vascular surgeon, plastics and reconstructive surgeon is needed. Prevention is far more better than cure, hence care of the foot must become a routine in patients with diabetes.

3) WET GANGRENE OF THE FOOT[8]

Sudden loss of perfusion in a already compromised microcirculation results in wet gangrene of the foot. It is the late manifestation of diabetic microangiopathy.

4) ERYSIPELAS-LIKE ERYTHEMA[15]

Well-defined erythema occur on the legs or feet of elderly patients with an average duration of diabetes mellitus of 5 years. It heralds the onset of Charcot arthropathy. There is no fever, elevated ESR or leucocytosis and it seems to be an important sign of localized functional microangiopathy.

5) DIABETIC DERMOPATHY[55]

Also called as shin spots or pigmented pretibial patches. Most common dermatosis associated with diabetes mellitus. Described by Melin[56] as atrophic circumscribed brown patches in the front and sides of the lower portion of both the legs. Early lesions are small, flat-topped, dull, red painless papules later those lesions progress to atrophic hyper-pigmented irregular patches approximately 5 to 12 mm in diameter.[57] The lesions are most commonly located on the anterior shins, as well as on the forearms, anterior thighs, and feet more over bony prominences.[35] Histologically the dermal arterioles and capillaries show thickening and PAS positive fibrillar material deposition in the vessel walls. Hemosiderin deposits due to extravasation of red blood cells are also seen. Diabetic dermopathy has been found to be associated with diabetic retinopathy, neuropathy, and nephropathy.[58]

6) DIABETIC RUBEOSIS[17]

A peculiar rosy reddening of the face and sometimes of the hands and feet may be seen. It has been attributed to diabetic microangiopathy or decreased vascular tone in long standing diabetes. Erythema occurs due to the decreased ability of the thickened dermal vessels to vasoconstrict[59]. Sun protection and avoidance of topical irritants and dietary vasodilators such as alcohol, coffee or tea may be helpful[19].

7) CALCIPHYLAXIS[60]

Calciphylaxis, also known as calcific uremic arteriolopathy, is a small-vessel vasculopathy causing mural calcification with intimal proliferation, fibrosis, and thrombosis. It manifests as poor-healing, necrotizing skin ulcers with a livedo like reticular pattern. Risk factors are renal failure, female gender, white, obesity and diabetes(especially type 2 diabetes).[61] Penile necrosis has been described in patients with a long history of diabetes on dialysis.[62]

NEUROLOGICAL DAMAGE

Elderly patients in whom the onset of diabetes is insidious are especially at risk of developing diabetic neuropathy due to damage to endoneural microvessels.[17] Commonly, there is a distal symmetrical polyneuropathy with mixed motor and sensory nerve involvement.

1) AUTONOMIC NEUROPATHY[63]

Autonomic nervous system may be the first nervous tissue affected in diabetics and mostly affect the feet. The important physical finding is the decreased or absent sweating of the lower extremities with increased sweating elsewhere in the body.

Thus it may lead to xerosis, cracking, fissuring , burns, ulcerations and callus.[15] Patients with diabetic sensory neuropathy have accompanying autonomic involvement.

2) MOTOR NEUROPATHY

Motor neuropathy of the foot is characterized by hammer toes, pescavus, subluxation of digits, distally displaced plantar fat pads and depressed metatarsal heads.

3) SENSORY NEUROPATHY

Patient complaints of tingling, numbness, burning sensation and aching symptoms more during night[17] mainly in lower limbs. Restless leg and burning feet are common complaints.

4) DIABETIC CHARCOT ARTHROPATHY

Diabetic charcot arthropathy[64] typically presents as a warm, swollen and erythematous foot and ankle mimicing cellulitis. It is due to a combination of motor, sensory and autonomic neuropathy. The foot becomes deformed with distally displaced plantar fat pads, depressed metatarsal heads, hammer toes and pescavus. It is due to circulatory abnormalities, trauma and abnormal pressure points leading to dislocation and the fusion of joints, fracture and bone resorption. Proper foot care is essential to prevent formation of perforating ulcers (‘mal perforans’).

OBESITY AND HYPERLIPIDEMIA RELATED SKIN DISEASES

1) ACANTHOSIS NIGRICANS

Smooth, velvety, hyperkeratotic, hyperpigmented skin[17] predominantly affecting the flexures is most commonly seen in obese type 2 diabetic patients. It is the skin marker of insulin resistance states. Skin tags are commonly associated with them. Mutation in the insulin receptor, anti bodies to insulin receptor as well as post receptor mutation causes insulin resistance which leads to hyperglycaemia. The final common pathway is probably via stimulation of tyrosine kinase growth factor receptors in the epidermis [65] leading to excessive epidermal growth.

Histologically, there is hyperkeratosis and papillomatosis as well as mild acanthosis of the epidermis.

2) ACROCHORDONS[17]

Skin tags are small, soft, pedunculated lesions occurring on the eyelids, neck and axillae, which are often associated with obesity. They are said to be the marker for diabetes, independent of obesity and acanthosis nigricans.

3) XANTHOMAS

A) Eruptive Xanthomas[17]

Eruptive xanthomas may develop dramatically in diabetics with hyperlipidaemia resulting in a significant risk of pancreatitis. Decreased

lipoprotein lipase activity in IDDM results in elevated serum triglycerides level. Cutaneous xanthomas occurs when the serum triglyceride level rises to 1000 mg/dl.[66] It presents as multiple, small, reddish yellow papules over the extensor surfaces and buttocks. It is more common in males. The lesions slowly resolve when the diabetes and hyperlipidaemia are properly managed.

Histopathology[67]shows admixture of non-foamy cells, among them macrophages, lymphocytes, neutrophils, whereas the number of well developed foamy cells are small. Extracellular lipids are found. Well-developed eruptive xanthomas are rich in foamy cells.

B) Xanthelasma Palpebrarum

It is characterized by plane xanthomas occurring more commonly in the eyelids. It is common in females. It is associated either with increase in serum cholesterol levels or no lipid abnormality. It does not regress even when therapy for diabetes is started.

GRANULOMATOUS DISORDERS

1) NECROBIOSIS LIPOIDICA

First described by Oppenheim in 1929. One of the known cutaneous markers of diabetes mellitus. It occurs in 0.3-0.7% of diabetics.[68] One study found that only 22% of NLD patients developed diabetes or impaired glucose tolerance

over a 15-year follow-up.[69] Women are three times more commonly affected than men with an average age of onset of 30 years in patients with diabetes.

The etiology of NLD remains unknown. Diabetic microangiopathy has been suggested etiology. The abnormal collagen is due to accelerated ageing of collagen in diabetes, abnormal collagen cross-linking, or overhydrated collagen produced in response to osmotic effects generated by the end products from the aldose reductase pathway.[70]

The lesions are usually bilateral, asymptomatic occurring in the pretibial skin as irregular ovoid plaques, with violaceous indurated periphery and a yellow central atrophic area. Superficial telangiectasia may be noted. Ulceration occurs in 35% of the cases.[71]Although most commonly found on the lower legs(85% of cases involve only the legs), other locations include the hands, fingers, forearms, face, and scalp.[72] Patients may complain of pruritus, dysesthesia, or pain at the site of lesions. More frequently the lesions of NLD are asymptomatic, and it is the cosmetic concern to the patient.

Histopathology of the skin lesion reveals necrobiotic reaction with large areas of necrobiotic collagen seen in the lower two third of the dermis and the infiltrate consisting of histiocytes, fibroblasts, lymphocytes surrounds the necrobiotic areas and adjacent fat. Giant cells may be seen and the extracellular lipid deposits are typical and scattered between the degenerating fibres. Blood vessels shows endothelial thickening and luminal occlusion.

Potent topical corticosteroids[73] applied to the inflammatory rim of lesions are thought to help control disease progression. Other agents used with variable results includes fibrinolytic agents such as stanozolol, pentoxifylline, aspirin, dipyridamole, ticlopidine, nicotinamide, and clofazimine. Recent reports described the resolution of extensive ulcerative NLD with oral cyclosporine and mycophenolate mofetil.[73]

2) GRANULOMA ANNULARE

21% of generalized GA and 10% localized GA are associated with[74] diabetes. Majority of the diabetics are insulin dependent diabetes with increased prevalence of HLA B8. Immunoglobin G (Ig G) and C3 have been found in blood vessels of involved skin, suggesting an immunological role.

It is clinically characterized by an annular or arciform configuration of flesh-colored or pale red papules and plaques located on the dorsa of the hands and feet. Generalised GA is characterized by a symmetrical eruption of hundreds of tiny papules, occurring all over the body surface. Mauriac's[75] syndrome is characterized by juvenile onset diabetes, stunted growth, hepatomegaly and granuloma annulare.

Treatment is often unsatisfactory, but fortunately the disease is usually asymptomatic and self limiting. Localized disease is treated mainly by topical or intralesional steroid. Treatment of disseminated GA is difficult. Therapy includes

the use of systemic steroids, potassium iodide, antimalarials, nicotinic acid and dapsone.[76]

STIFF SKIN AND JOINTS[13]

Skin thickening and stiff joints are due to irreversible cross-linking of collagen and other proteins in the skin and accumulation of AGEs such as carboxymethyllysine and pentosidane receptors for AGE products stimulates several inflammatory and fibrogenic growth factors and cytokines via protein kinase C. There is no definitive treatment. Improved diabetic control is likely to be helpful. Aspirin reduces glycol-oxidative damage but the effect is slow.

Physiotherapy may also help to maintain mobility. Other treatments include phototherapy, photophoresis, radiotherapy, prostacyclin, high dose penicillin, cyclosporine and factor XIII.

1) FINGER PEBBLES[77]

They are seen both in Type I and Type II diabetes mellitus. In diabetic patients with thick skin, the dorsal surfaces of the fingers develops tiny skin-colored grouped papules[77] and thickening giving a characteristic pebbled appearance over or near the knuckles called as ‘Huntley’s papules’ or ‘Garrod’sknuckle pads’.

2) DIABETIC THICK SKIN (CHEIRO ARTHROPATHY)[17]

This is characterized by waxy tight skin on the backs of the hands and limited joint mobility (‘prayer sign’). It is an index of underlying microvascular changes neuropathy, retinopathy. It is demonstrated by inability to approximate the two palms with hands pressed together[78] and fingers separated in extension called the “PRAYER SIGN”. It is due to the accelerated and irreversible non-enzymatic glycosylation of the dermal collagen.

3) SCLEREDEMA DIABETICORUM[17]

The condition is mainly seen in overweight adults with type 2 diabetes. It is characterized by ill-defined induration of the skin, most commonly on the neck and upper back. Spread to the face, shoulder and anterior torso may occur.[79] The skin retains a non pitting, woody, peau’d orange quality.[80]The pathogenesis is postulated to be unregulated production of extracellular matrix molecules by fibroblast leading to thickened collagen bundle and increased deposition of glycosaminoglycans. It is essentially permanent, painless and usually causes little morbidity.

DERMATOSES FREQUENTLY ASSOCIATED WITH DIABETES

1) PRURITUS

There is increased prevalence of truncal pruritus often in association with autonomic neuropathy.[81]In all cases systemic diseases should be ruled out. Anogenital pruritus may be due to candidiasis or haemolytic streptococci.[8] Persistent localized pruritus of the scalp is a sign of diabetic neuropathy[82] and is extremely refractory to treatment.

2) DIABETIC BULLAE

Bullous diabeticorum or idiopathic bullae of diabetes are distinct markers of diabetes. It characterized by abrupt onset of painless and pruritic bullae on the leg and feet. Heals over several weeks without scarring. Histopathological examination of the bullae shows an inconsistent level of separation varying from intra epidermal to sub-epidermal.[83] Increased skin fragility may play a role in diabetic bullae. Perhaps the formation of advanced glycosylation end products lead to increased fragility.[84] Treatment is symptomatic.

3) PERFORATING DERMATOSES

Kyrles disease, perforating folliculitis and acquired perforating dermatoses are noted in patients with diabetic nephropathy on hemodialysis.[85] It is a chronic, usually asymptomatic disease consisting of bilateral scattered papules with horny

cone shaped plugs, limited to the extensor surface of the arms, sacral region, legs, and buttocks. It is attributed to glycosylation of collagen and minor injury such as pressure or scratching.[8]

4) YELLOW SKIN AND NAIL

Yellow skin and nails have been reported to be more frequently seen in patients with diabetes due to carotene[8] and non-enzymatic glycosylation of dermal collagen that eventually become yellow.

5) GENETIC AND OTHER SYSTEMIC DISEASES

Diabetes is a feature of several genetic diseases[8] including Werner syndrome, lipoid proteinosis and autoimmune polyendocrine syndrome. It is seen in many systemic diseases like Hemochromatosis, Cushing syndrome, acromegaly and the various lipodystrophies(familial partial lipodystrophy, acquired partial lipoatrophy and HIV-associated lipodystrophy)

6) AUTOIMMUNE DISEASES

Greater frequency of other autoimmune disorders[86] include thyroid disease (more commonly hypothyroidism), coeliac disease (4–9%), vitiligo (4.5%), alopecia areata, Addison disease (0.5%) and the associated dermatological manifestations of those diseases (Dermatitis herpetiformis and Pretibial myxoedema).

Dawber et al[87] found Vitiligo present in 4.8% of patients with adult onset diabetes, as compared with 0.7% to 1% of the general population.

7) NAIL CHANGES[88]

INFECTIONS - Acute paronychia, chronic paronychia and onychomycosis.

VASCULAR LESIONS – Pterygium inversum unguis, pterygium, beau's lines and onychohauxis.

NEUROPATHY- Reflex sympathetic dystrophy, trauma

MISCELLANEOUS – Rosenau's depression, Leukonychia, Onychomadesis, Yellow nail syndrome, toe-nail thickening, abnormal curvature, hypertrophy of nail plate and ingrown toe nail.

8) BULLOUS PEMPHIGOID[89]

Bullous pemphigoid is associated with Type I diabetes mellitus. 20-40% of these patients have diabetes. Enzymatic glycosylation of glycoprotein at the lamina-lucida level acts as an antigen.

9) PSORIASIS[90]

The incidence observed is 2.4% but there is no convincing association is found between abnormal glucose tolerance test and surface area involvement by psoriasis.

10) LICHEN PLANUS[91]

The prevalence of diabetes in patients with lichen planus varies from 1 to 37%. The prevalence of oral lichen planus is found to be more in IDDM who smoke and those with history of candidiasis and they were of erosive type.

11) MISCELLANEOUS DERMATOSES

Macular amyloidosis, Cherry angioma and Eruptive syringomas are other associated dermatoses. There is indirect association between diabetes and both nephrogenic fibrosing dermopathy and calciphylaxis.

TREATMENT RELATED SKIN MANIFESTATIONS

1) INSULIN DYSTROPHY

Both atrophy and hypertrophy may occur even with newer synthetic insulin. Insulin induced lipohypertrophy affected almost two-thirds of patients and are more common in males. It is more common in patients who do not rotate the site of injection of insulin[92] and can lead to impaired insulin absorption and poorer diabetic control. Lipoatrophy appears to be an immunological reaction [49]. The introduction of synthetic insulin has made it to 1-2%.[93-95] Keloid and hypertrophic scar are found in prone diabetics.

2) ALLERGIC REACTIONS TO INSULIN

Localized allergic reactions to insulin include urticaria[94], painful nodules and granulomas. The use of an insulin pump may help, but contact dermatitis is reported.

3) ALLERGIC REACTIONS TO ORAL HYPOGLYCEMIC DRUGS

Sulphonylurea are the most common culprits, particularly a disulfiram like reaction to chlorpropamide. Photosensitivity, pruritus, erythema multiforme, erythema nodosum, urticaria, fixed drug eruption, lichenoid and morbilliform eruptions have all been described[96]. Among the new oral therapies, alpha glucosidase inhibitor Acarbose[97] was recently reported to cause erythema multiforne after two weeks of therapy.

AIMS AND OBJECTIVES

1) To evaluate the prevalence of various skin disorders in patients with diabetes mellitus.
2) To analyze the prevalence and pattern of skin disorders among diabetes mellitus patients in this tertiary care center in Chennai.
3) To study the correlation between mean duration of diabetes mellitus and their skin manifestations.
4) To compare the dermatoses in insulin dependent diabetes mellitus with those of non-insulin diabetes mellitus.
5) To study about the treatment related skin manifestations.

MATERIALS AND METHODS

1) Prospective observational study involving 200 consecutive patients either attending dermatology OPD with skin features related to diabetes or referred from diabetologydepartment.
2) A detailed medical history pertaining diabetes was elicited in each patient with particular reference to the cutaneous complaints including duration, history of evolution and progression.
3) An informed consent was taken from each patient, after which a general physical examination, systemic examination and a detailed dermatological examination carried out and the relevant details recorded and tabulated.
4) Specific and non-specific skin findings related to diabetes mellitus was documented.
5) Apart from routine laboratory investigations, F.B.S, P.P.B.S, Lipid profile for all cases. Bedside laboratory procedures like the Tzanck smear, KOH mount, and Gram's stain were carried out wherever needed.
6) Skin biopsy was done in selected cases to confirm the diagnosis.
7) Statistical analysis of various cutaneous findings was performed by appropriate statistical methods and inferences were drawn.

Inclusion criteria:

1) All patients who attend dermatology op with skin findings suggestive of diabetes mellitus.
2) All patients with known diabetes mellitus and skin manifestations referred from diabetology department.

Exclusion criteria:

1) Patients not willing for study.
2) Those who having other associated endocrine diseases.

ETHICAL ISSUES:

Participants were made aware about the nature and purpose of the study. Willingness and signature of the participants were taken on a consent form.It was also informed to all that all the data provided by the patients will be kept confidential and will be used only for the study purpose. Written consents were obtained from all the subjects who participated in the study before the study was started. Institutional ethics committee of Madras medical college reviewed the study proposal for ethical consideration and approval.

STATISTICAL ANALYSIS:

Data recorded was analyzed statistically by SPSS software. Using chi square test, prevalence and pattern of various cutaneous manifestations among diabetics was arrived.

OBSERVATIONS AND RESULTS

Cutaneous manifestations found in our study are delineated according to classification by Huntley[8] .In our study 72.5%(145) patients were NIDDM/Type 1 DM and 55 patients (27.5%) were IDDM/Type 2 DM. We could not find any specific type of diabetes (pancreatic, hormonal, genetic, drug induced) or gestational diabetes with cutaneous manifestations in our study.

AGE INCIDENCE:

The age of patients found in IDDM ranged from 16 – 40 with the mean of 27 years whereas the age in NIDDM patients ranged from 35 – 72 with the mean of 52 years.

Table 1 : Comparison of age distribution among the two groups (n=200)

Diabetes	Mean Age	Std. Deviation	Mean difference	p value	95% confidence interval
Type 1 DM	27.0	5.85	-25.29	<0.001	-27.8 to -22.79
Type 2 DM	52.3	8.68			

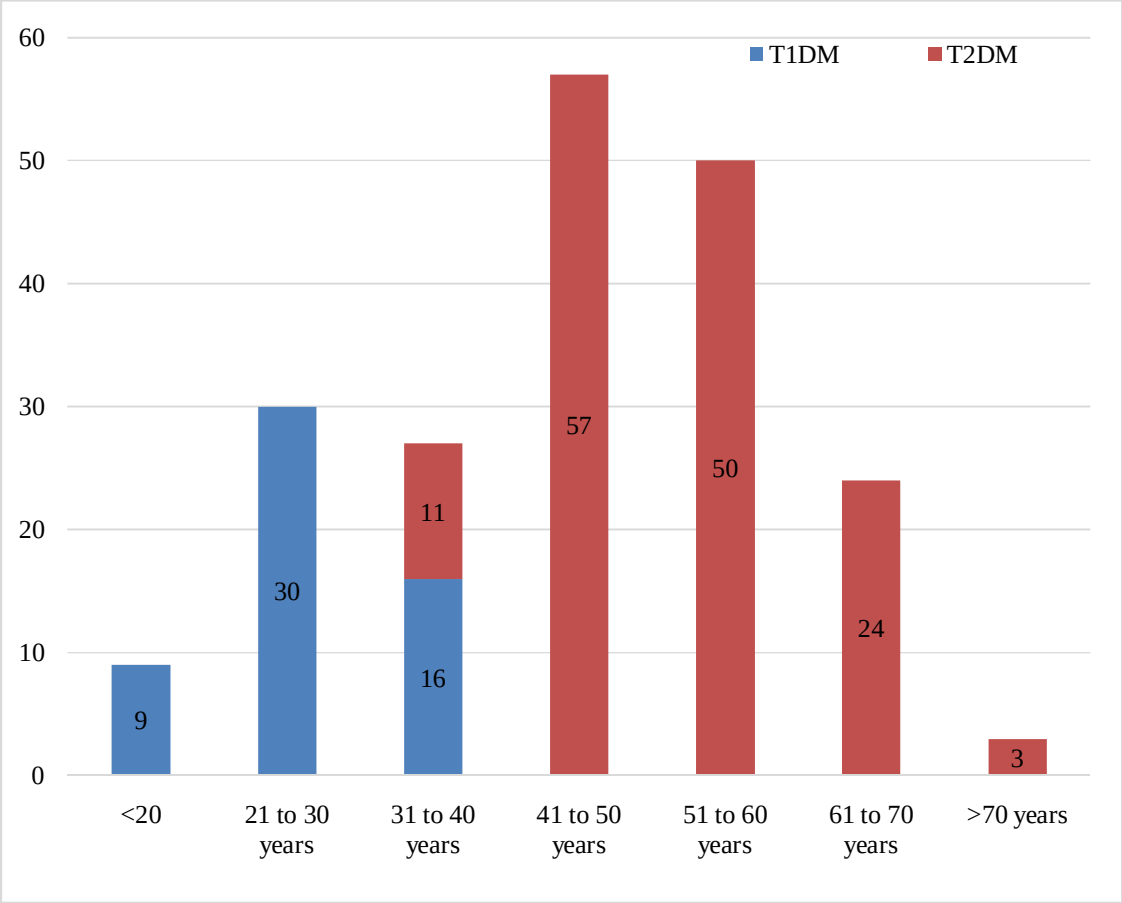
Comments: Subjects with Type 2 DM had a higher mean age than subjects with Type 1 DM and this difference in mean age was statistically significant.

Table 2 : Age distribution of the study population (n=200)

Age group	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
<20 years	9 (16.4)	0 (0)	9 (4.5)
21- 30 years	30 (54.5)	0 (0)	30 (15)
31 – 40 years	16 (29.1)	11 (7.6)	27 (13.5)
41 - 50 years	0 (0)	57 (39.3)	57 (28.5)
51 - 60 years	0 (0)	50 (34.5)	50 (25)
61 - 70 years	0 (0)	24 (16.6)	24 (12)
>70 years	0 (0)	3 (2.1)	3 (1.5)
Total	55 (100)	145 (100)	200 (100)

Comments: In type 1 DM, 54.5% fall under 21 – 30 years of age and in Type 2 DM, 39.3% under 41 – 50 years of age.

Chart 1 Age distribution of the study population (n=200)



GENDER INCIDENCE :

Out of 200 patients, 98 were males and 102 were females so male : female ratio is of 0.96:1.Thus slight female preponderance was noted in our study. Out of 55 IDDM patients, 30(54.5%) were males and 25(45.5%) were females. Out of 145 NIDDM patients,68(46.9%) were males and 77(53.1%) were females.

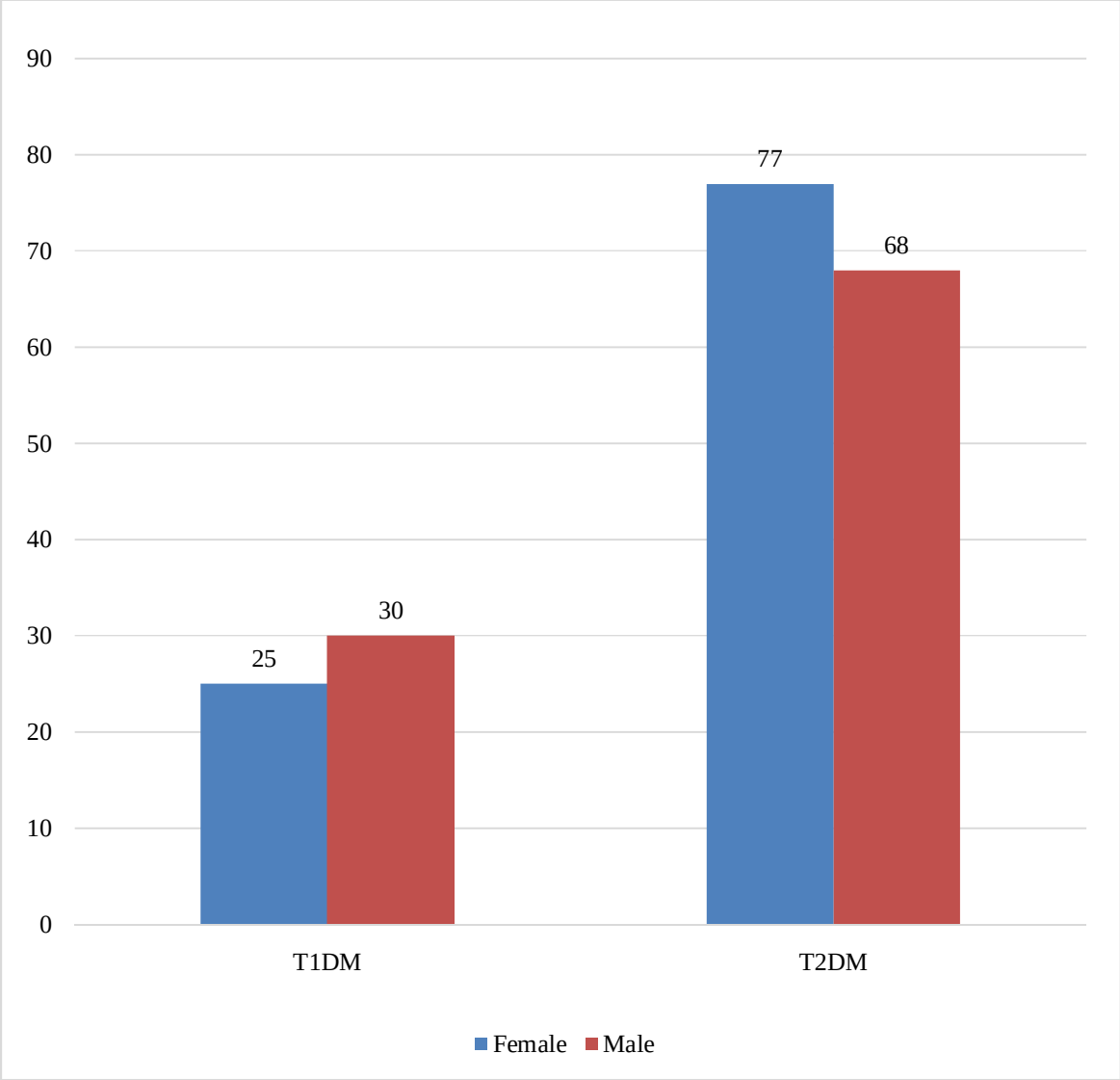
Table 3 Gender Distribution of the study population (n=200)

Gender	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Female	25 (45.5)	77 (53.1)	102 (51)
Male	30 (54.5)	68 (46.9)	98 (49)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 0.934, p value: 0.334

Comments: The difference in distribution of the study population according to gender was not statistically significant ($p>0.05$) between the groups. Hence both the groups are comparable.

Chart 2: Gender Distribution of the study population(n=200)



DURATION OF DIABETES :

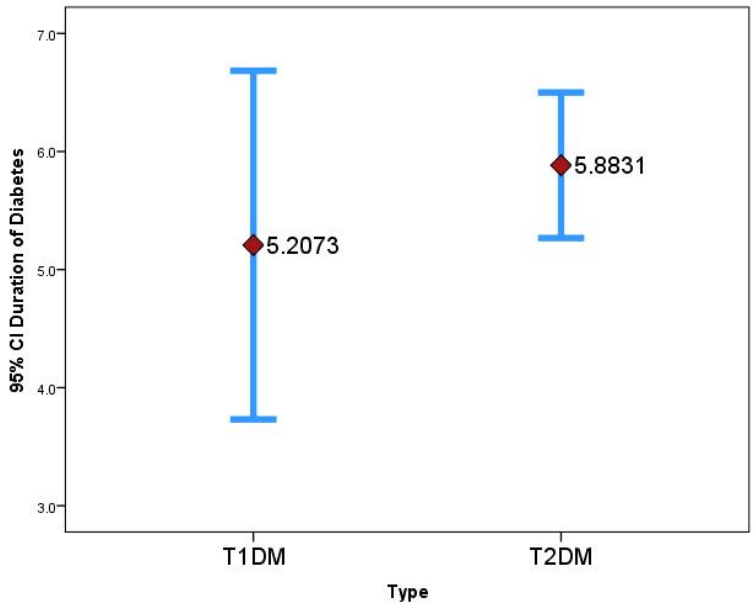
Mean duration of type 1 DM in our study was found to be around 5.2 years and in type 2 DM around 5.9 years. This difference in mean duration of disease was statistically significant.

Table 4 Comparison of duration of Diabetes among the two groups (n=200)

Diabetes	Mean Duration	Std. Deviation	Mean difference	p value	95% confidence interval
Type 1	5.207	5.4600	-0.67	0.321	-2.01 to -0.66
Type 2	5.883	3.7556			

Comments: Subjects with Type 2 DM had a higher mean duration of Diabetes than subjects with Type 1 DM and this difference in mean duration of disease was not statistically significant.

Chart 3: Duration of Diabetes among the two groups (n=200)



CUTANEOUS INFECTIONS ;

CANDIDIASIS:

In our study candidiasis was prevalent in 56 patients (28%)of the patients. Tab 5 shows the prevalence of candidiasis is found to be 28.3% in NIDDM and 27.3% in IDDM patients. Tab 6 shows In female patients of NIDDM vulvo-vaginal candidiasis was found to be the most common type while male patients had balanoposthitis as frequent type of candidiasis. Type 1 DM patients were found to have oral thrush and balanoposthitis as the most common types.

10% KOH wet mount examination of the scraping from the skin lesion showed blastospores and pseudohyphae in all the cases.

Table 5 Distribution of candidiasis in the study population (n=200)

Candidiasis	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	15 (27.3)	41 (28.3)	56 (28)
Absent	40 (72.7)	104 (71.7)	144 (72)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 0.020, p value: 0.888

Comments: The difference in distribution of Candidiasis among the study population was not statistically significant ($p>0.05$) between the groups with candidiasis being common among Type 2 than Type 1 Diabetes.

Chart 4 Distribution of candidiasis in the study population(n=200)

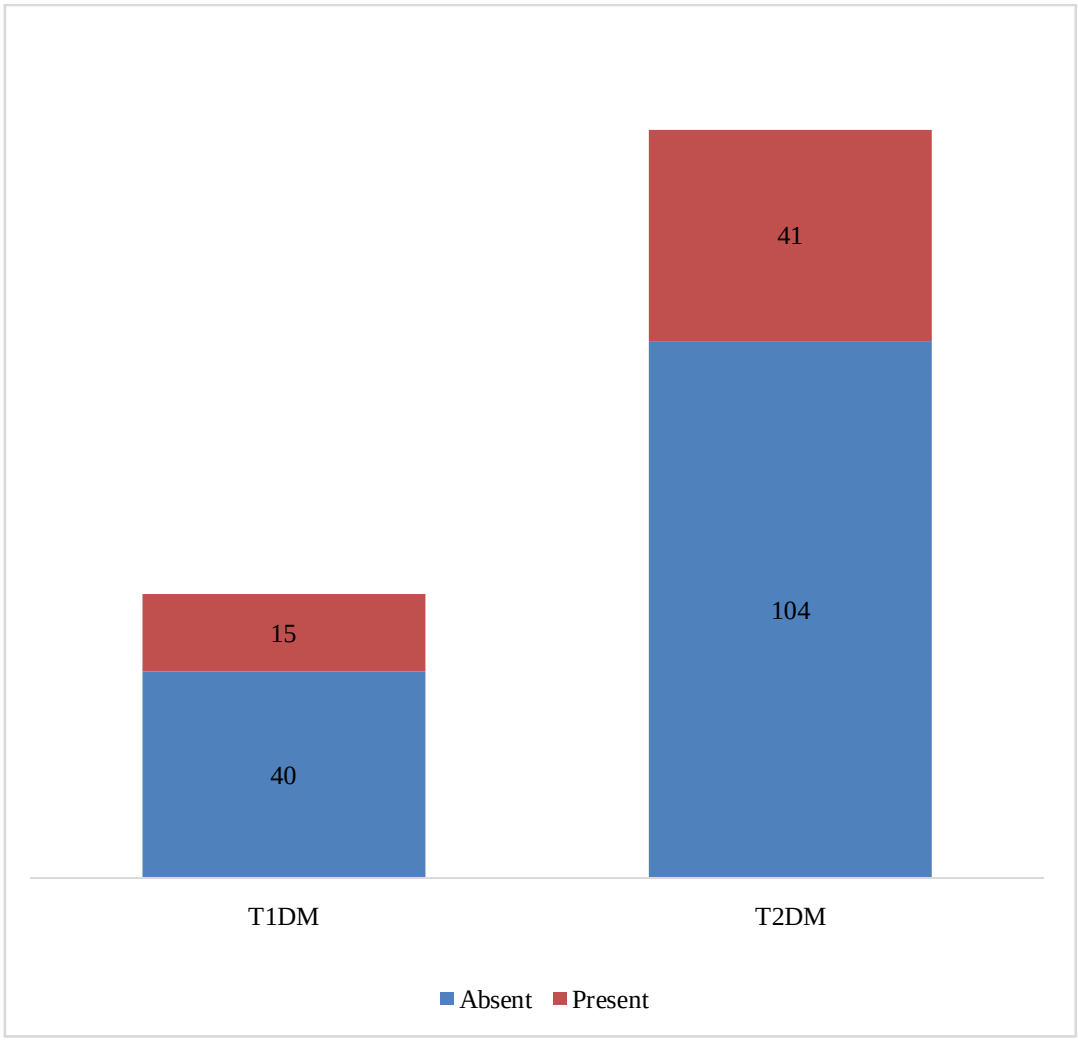


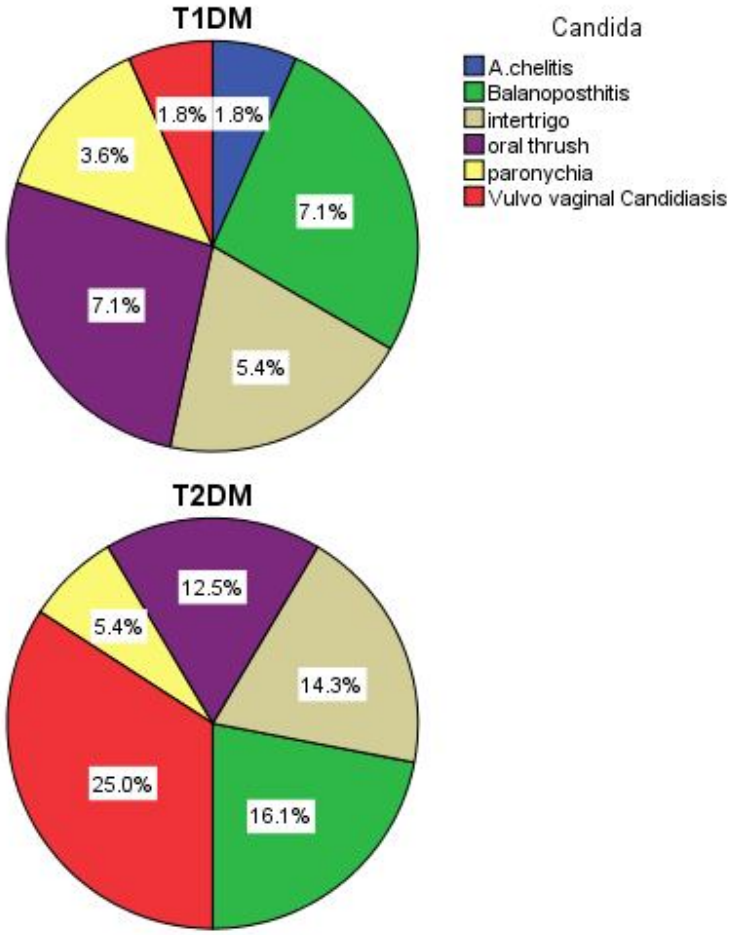
Table 6 Distribution of types of candida infections in the study population (n=56)

Type of candidiasis	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Vulvovaginal	1 (6.7)	14 (34.1)	15 (26.8)
Intertrigo	3 (20)	8 (19.5)	11 (19.6)
Oral thrush	4 (26.7)	7 (17.1)	11 (19.6)
Paronychia	2 (13.3)	3 (7.3)	5 (8.9)
Balanoposthitis	4 (26.7)	9 (22)	13 (23.2)
Angular cheilitis	1 (6.7)	0 (0)	1 (1.8)
Total	15 (100)	41 (100)	56 (100)

Chi-square value: 6.89, p value: 0.229

Comments: The difference in distribution of different types of candida infections among the study population was not statistically significant ($p>0.05$).

Chart 5: Distribution of types of candida infections in the study population(n=56)



DERMATOPHYTE INFECTIONS :

Among our study group totally 37 patients (18.5%) had dermatophyte infections. Prevalence in type 1 DM is 16.4% and type 2 is 19.3%. Tinea corporis is most common type in both IDDM and NIDDM. 3 patients in type 1 DM and 7 patients in type 2 DM were found to have chronic dermatophytosis.4 patients in NIDDM were recurrent and refractory to treatment with systemic antifungals. No cases of Tinea capitis was found in our study. Wet mount examination of the skin lesions in 10% KOH showed long hyaline branching septate hyphae and arthrospores in almost the cases.

Table 7 Distribution of dermatophytosis in the study population (n=200)

Dermatophytosis	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	9 (16.4)	28 (19.3)	37 (18.5)
Absent	46 (83.6)	117 (80.7)	163 (81.5)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 0.230, p value: 0.632

Comments: The difference in distribution of Dermatophytosis among the study population was not statistically significant ($p>0.05$) between the groups with Dermatophytosis being common among Type 2 than Type 1 Diabetes.

Chart 6: Distribution of dermatophytosis(n=200)

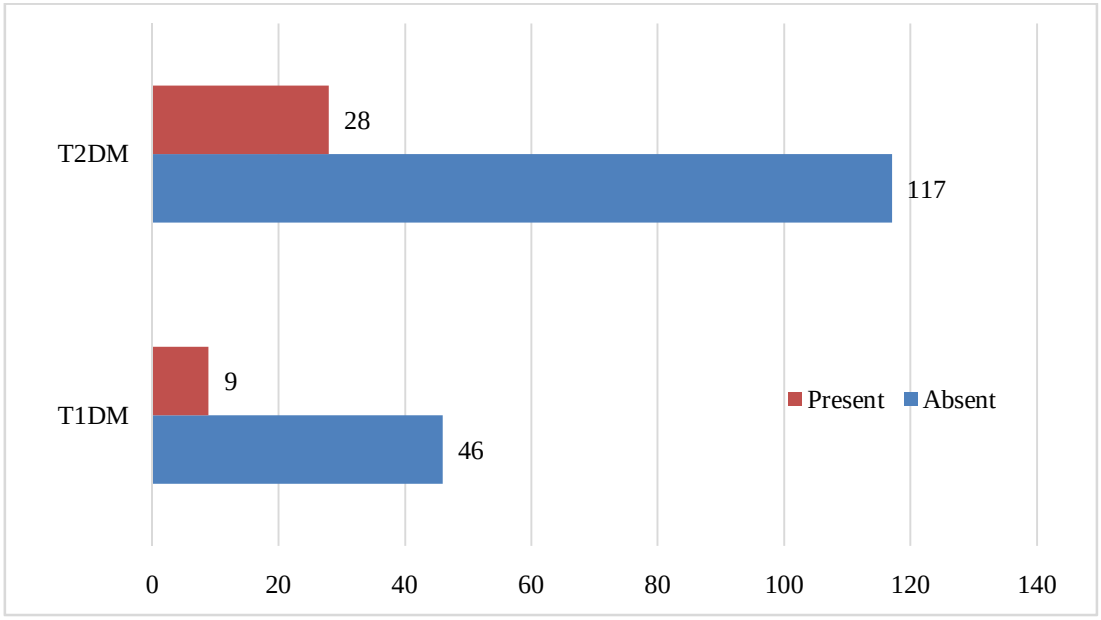


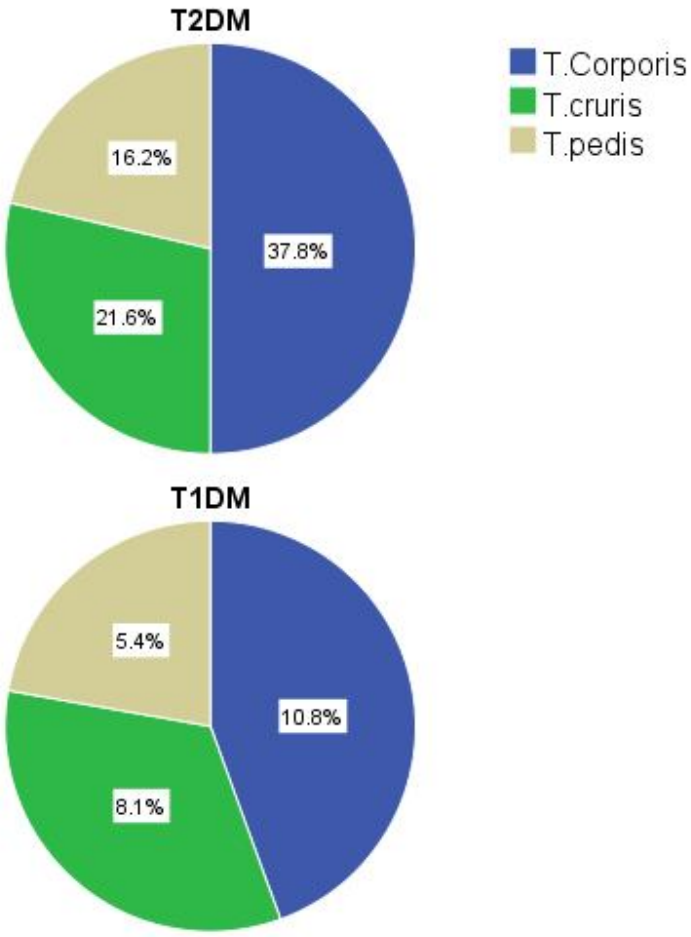
Table 8 Distribution of types of dermatophytosis in the study population (n=37)

Dermatophytosis	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Tinea corporis	4 (44.4)	14 (50)	18 (48.6)
Tinea cruris	3 (33.3)	8 (28.6)	11 (29.7)
Tinea pedis	2 (22.2)	6 (21.4)	8 (21.6)
Total	9 (100)	28 (100)	37 (100)

Chi-square value: 0.097, p value: 0.953

Comments: The difference in distribution of different types of dermatophytosis among the study population was not statistically significant ($p>0.05$).

Chart 7: Types of dermatophytosis in the study population(n=37)



PITYRIASIS VERSICOLOR :

Prevalence of Pityriasisversicolor was found to be 12.5% among our diabetic patients of which more commonly seen in type 1 DM(21.8%) than type 2 DM (9%).Clinically they had well defined hypopigmented macules and patches with branny scales distributed mainly seborrheic areas such as upper chest, back and face. Two of the patients were found to have perifollicular type and one had

recurrent type. Almost all patients were responded well to topical clotrimazole and single dose of fluconazole 400mg.

KOH Wet mount of the scales showed hyaline short straight angulated hyphae with blastospores giving the appearance of sphaghetti and meatball.

Table 9 Distribution of Tinea versicolor in the study population (n=200)

Tinea versicolor	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	12 (21.8)	13 (9)	25 (12.5)
Absent	43 (78.2)	132 (91)	175 (87.5)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 6.022 , p value: 0.014

Comments: The difference in distribution of Tinea versicolor among the study population was statistically significant ($p<0.05$) between the groups with Tinea versicolor being common among Type 1 than Type 2 Diabetes.

MUCOR MYCOSIS :

Though rare, one case of rhinocerebral zygomycosiswere noted in our study. He presented with facial, eyelid edema, black eschar and palatal erosions. He had diabetes type 2 with duration of about 7 years with ketoacidosis.

KOH Wet mount of eschar showed broad ribbon like and irregularly shaped non septate hyphae with branches at right angles. Culture showed greyish white

flat colonies with wooly texture adherent to plate surface. HPE and PAS stain showed broad ribbon like and irregularly shaped non septate hyphae with branches at right angles.

He was advised IV amphotericin B and surgical debridement.

PRIMARY BACTERIAL INFECTIONS:

Most common bacterial infection was observed to be furunculosis in our study with the prevalence of 10.5%. It was found to be more common in NIDDM patients. Other primary bacterial infections found were impetigo, folliculitis and abscesses.

Gram stain of the discharge showed gram positive cocci arranged in groups and chains consistent with both staphylococcus and streptococcus. Out of 21 patients four had recurrent furunculosis and MRSA growth on culture.

Cellulitis due to deeper subcutaneous tissue involvement was found in 6 patients(3%). NIDDM patients were found to be common in them with prevalence of 3.4% compared to IDDM patients(1.8%). Mean duration of diabetes was 6.5 years.

Two type 2 DM patients had erysipelas manifesting as tender erythematous edematous slightly elevated skin that spreads peripherally over lower limb. Both patient had 8 years duration of type 2 diabetes. Gram stain of the discharge showed streptococci and responded well to antibiotics.

Table 10 Distribution of Furunculosis in the study population (n=200)

Furunculosis	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	4 (7.3)	17 (11.7)	21 (10.5)
Absent	51 (92.7)	128 (88.3)	179 (89.5)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 8.41 , p value: 0.359

Comments: Furunculosis was common among Type 2 than Type 1 Diabetes but this difference in distribution of Furunculosis among the study population was not statistically significant (p>0.05).

Table 11 Distribution of Erysipelas in the study population (n=200)

Erysipelas	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	0 (0)	2 (1.4)	2 (1)
Absent	55 (100)	143 (98.6)	198 (99)
Total	55 (100)	145 (100)	200 (100)

Comments: Only 2 subjects were diagnosed with erysipelas among Type 2 Diabetes and there was no case of erysipelas among the Type 1 diabetics.

CORYNEBACTERIAL INFECTIONS :

Most common corynebacterial infection seen in our study was erythrasma (8%). Type 1 DM were found to have increased incidence (20%) than type 2 (3.4%). It was found to be more in obese patients involving mainly over axilla and groin. Wood's lamp examination showed coral red colour consistent with erythrasma.

Next common corynebacterial infection observed in our study was keratolysis punctate manifesting as pits over palms, soles and dorsum of hands. Prevalence was found to be 2% of the total study group with type 1 DM (3.6%) more than type 2 (1.4%). It was found more in females who were homemakers. Trichomycosis axillaris was not found in our study.

Table 12 Distribution of Erythrasma in the study population (n=200)

Erythrasma	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	11 (20)	5 (3.4)	16 (8)
Absent	44 (80)	140 (96.6)	184 (92)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 12.67 , p value: <0.001

Comments: The difference in distribution of Erythrasma among the study population was statistically significant ($p<0.05$) between the groups with Erythrasma being common among Type 1 than Type 2 Diabetes.

Table 13 Distribution of Keratolysis punctata in the study population (n=200)

Keratolysis punctata	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	2 (3.6)	2 (1.4)	4 (2)
Absent	53 (96.4)	143 (98.6)	196 (98)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 1.036 , p value: 0.309

Comments: Keratolysis punctata was common among Type 1 than Type 2 Diabetes but this difference in distribution of Keratolysis punctata was not statistically significant (p>0.05).

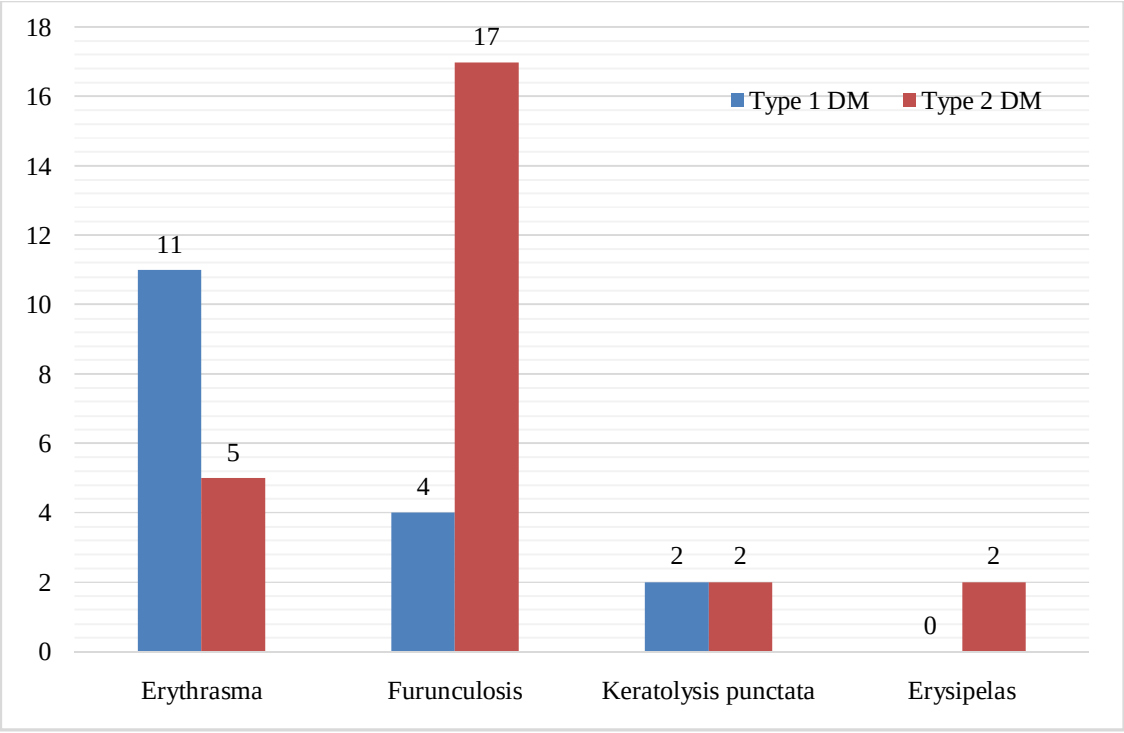


Chart 8: Distribution of various bacterial infections (n=200)

VIRAL INFECTIONS :

Among the 3 subjects diagnosed with viral infections in Type 2 Diabetes, 2 subjects had herpe zoster and 1 subject had Verucca while only 1 case herpes zoster was reported among the Type 1 diabetics.

Tzanck smear from zoster lesion showed multinucleated giant cell.

Table 14 Distribution of viral infections in the study population (n=200)

Viral infections	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	1 (1.8)	3 (2.1)	4 (2)
Absent	54 (98.2)	142 (97.9)	196 (98)
Total	55 (100)	145 (100)	200 (100)

p value: 0.910

Comments: Only 3 subjects were diagnosed with viral infections among Type 2 Diabetes while only 1 case reported with viral infection among the Type 1 diabetics and this difference was not statistically significant ($p>0.05$).

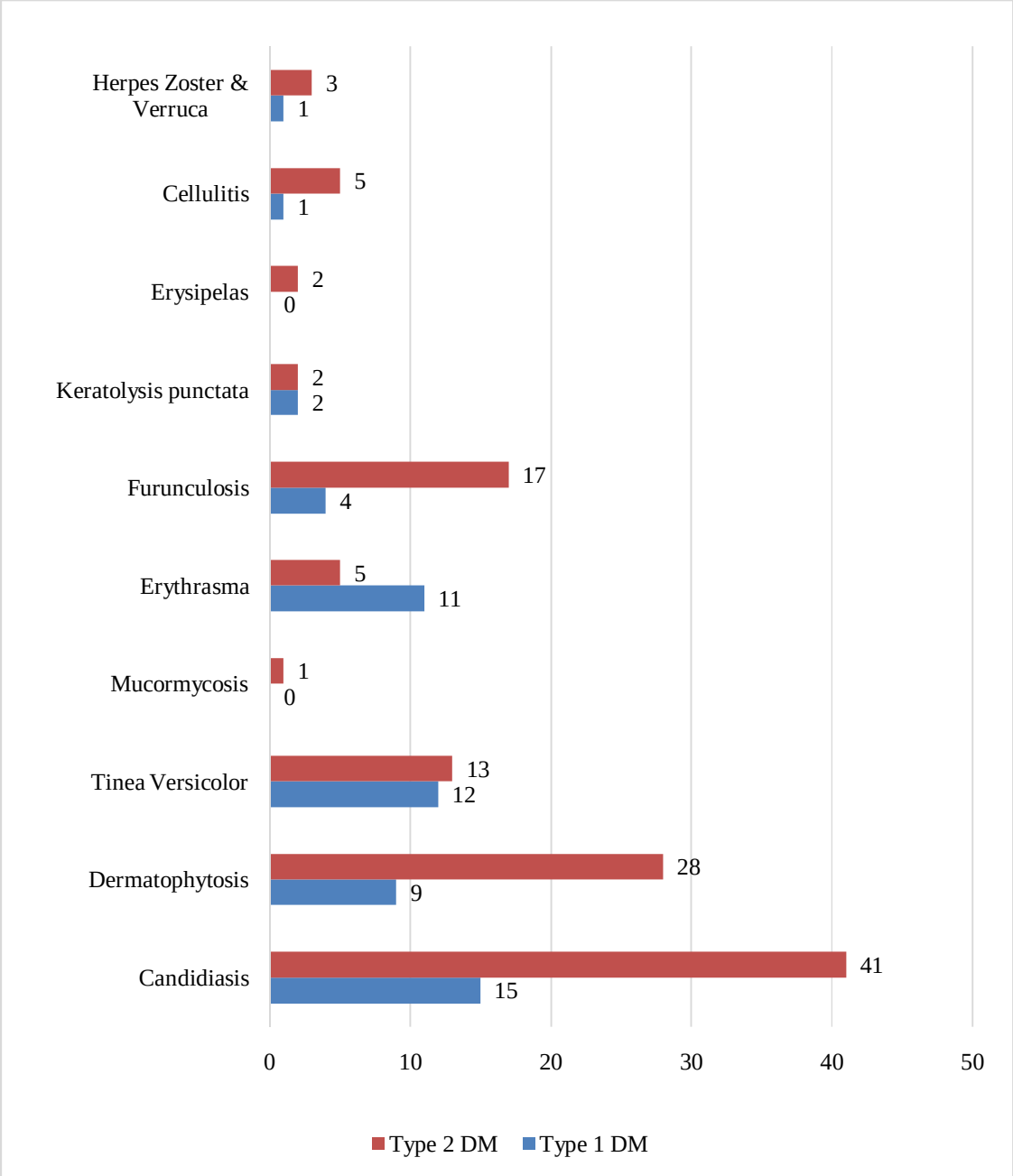
Table 15 Distribution of type of viral infections in the study population (n=4)

Viral infections	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Herpes Zoster	1 (100)	2 (66.7)	3 (75)
Verucca	0 (0)	1 (33.3)	1 (25)
Total	1 (100)	3 (100)	4 (100)

Table 16 Distribution of Cutaneous infections in the study population (n=200)

Cutaneous infections	Type	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Fungal	Candidiasis	15 (27.3)	41 (28.3)	56 (28)
	Dermatophytosis	9 (16.4)	28 (19.3)	37 (18.5)
	TineaVersicolor	12 (21.8)	13 (9)	25 (12.5)
	Mucormycosis	0 (0)	1 (0.7)	1 (0.5)
Bacterial	Erythrasma	11 (20)	5 (3.4)	16 (8)
	Furunculosis	4 (7.3)	17 (11.7)	21 (10.5)
	Keratolysispunctata	2 (3.6)	2 (1.4)	4 (2)
	Erysipelas	0 (0)	2 (1.4)	2 (1)
	Cellulitis	1 (1.8)	5 (3.4)	6 (3)
Viral	Herpes Zoster & Verruca	1 (1.8)	3 (2.1)	4 (2)

Chart 9: Distribution of various infections(n=200)



MANIFESTATIONS DUE TO VASCULAR DAMAGE :

LEG ULCERS:

Only 4 subjects were diagnosed with Leg ulcers among Type 1 Diabetes while 10 cases reported with Leg ulcers among the Type 2 diabetics. Four out of ten type 1 diabetes patients with leg ulcers had neuropathy either motor or sensory contributing to the causation of ulcers. Mean duration of type 2 DM was found to be 10 years with poor control of metabolic state.

Multidisciplinary approach in form of orthopedic, vascular surgery and good nursing care were given to rule out vascular and bone involvement in the ulcer.

Table 17 Distribution of Leg ulcers in the study population (n=200)

Leg ulcers	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	4 (7.3)	10 (6.9)	14 (7)
Absent	51 (92.7)	135 (93.1)	186 (93)
Total	55 (100)	145 (100)	200 (100)

p value: 0.926

Comments: Only 4 subjects were diagnosed with Leg ulcers among Type 1 Diabetes while 10 cases reported with Leg ulcers among the Type 2 diabetics but this difference was not statistically significant ($p>0.05$).

GANGRENE :

Gangrene of the foot indicating late manifestation of microangiopathy was reported in one type 2 diabetes patient. He was advised surgical debridement and was referred to surgery department.

DIABETIC DERMOPATHY :

One case of diabetic dermopathy manifesting as small, atrophic hyperpigmented irregular patches on the anterior shins. History of trauma was present.

NAIL CHANGES :

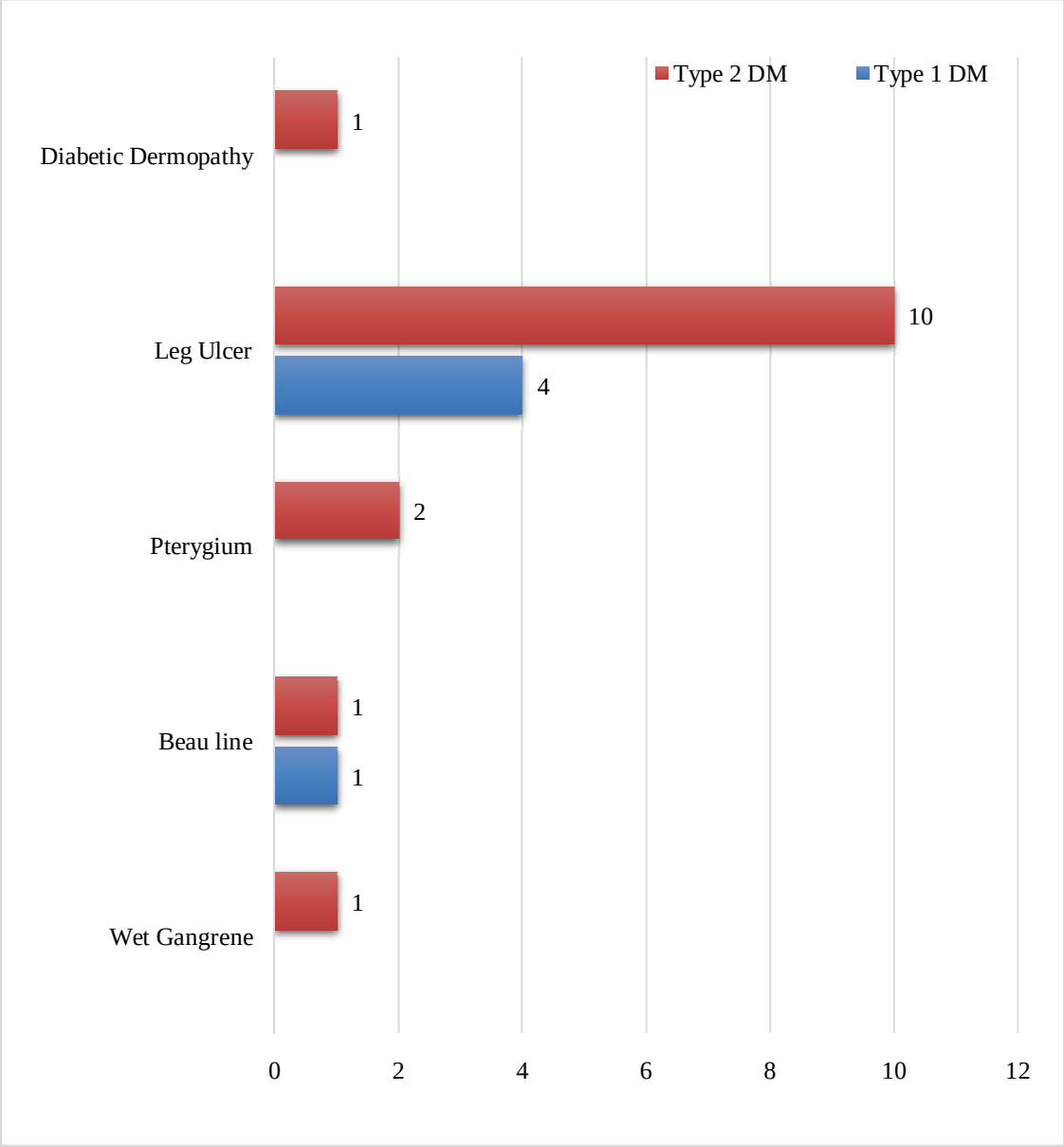
Paronychia was present in 5 (8.9%) patients of which IDDM was 11.5% and NIDDM was 6.7%. It presented as both acute and chronic painful swelling of proximal nail fold with discharge of pus and loss of cuticle. More commonly seen in patients who do household works. One patient was found to have greenish discoloration of nail fold suggestive of pseudomonas infection.

Pterygium was found in two of type 2 diabetes patients and leukonychia in three of type 2 diabetes patients.

Table 18 Distribution of lesions due to vascular damage in the study population (n=200)

Vascular damage	Type		Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Micro- angiopathy	Wet Gangrene		0 (0)	1 (0.7)	1 (0.5)
	Nail changes	Beau line	1 (1.8)	1 (0.7)	2 (1)
		Pterygium	0 (0)	2 (1.4)	2 (1)
Leg Ulcer			4 (7.3)	10 (6.9)	14 (7)
Diabetic Dermopathy			0 (0)	1 (0.7)	1 (0.5)

Chart 10: Distribution of lesions due to vascular damage (n=200)



NEUROLOGICAL DAMAGE:

Neuropathy was observed to be 33% of total study population more common in IDDM (45.5%) than NIDDM (28.3%). Motor neuropathy characterized by hammer toes was observed in one type 2 diabetes individual. Autonomic neuropathy manifested as fissures over soles, callus, xerosis over legs. both sensory and autonomic neuropathy was reported in 4 patients.

Table 19 Distribution of types of Neuropathy in the study population (n=66)

Neuropathy Type	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Autonomic	3 (12)	7 (17.1)	10 (15.2)
Motor	0 (0)	1 (2.4)	1 (1.5)
Sensory	19 (76)	32 (78)	51 (77.3)
Autonomic + Sensory	3 (12)	1 (2.4)	4 (6.1)
Total	25 (100)	41 (100)	66 (100)

Chi-square value: 3.224 , p value: 0.358

Comments: Sensory Neuropathy was the most commonest in both Type 1 and Type 2 Diabetes and the difference in distribution of neuropathy was not statistically significant ($p>0.05$).

Table 20 Distribution of neuropathy lesions in the study population (n=200)

	Type	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Neuropathy	Autonomic	3 (5.5)	7 (4.8)	10 (5)
	Motor	0 (0)	1 (0.7)	1 (0.5)
	Sensory	19 (34.5)	32 (22.1)	51 (25.5)
	Autonomic + Sensory	3 (5.5)	1 (0.7)	4 (6.1)

Chart 11: Distribution of neuropathy lesions (n=200)

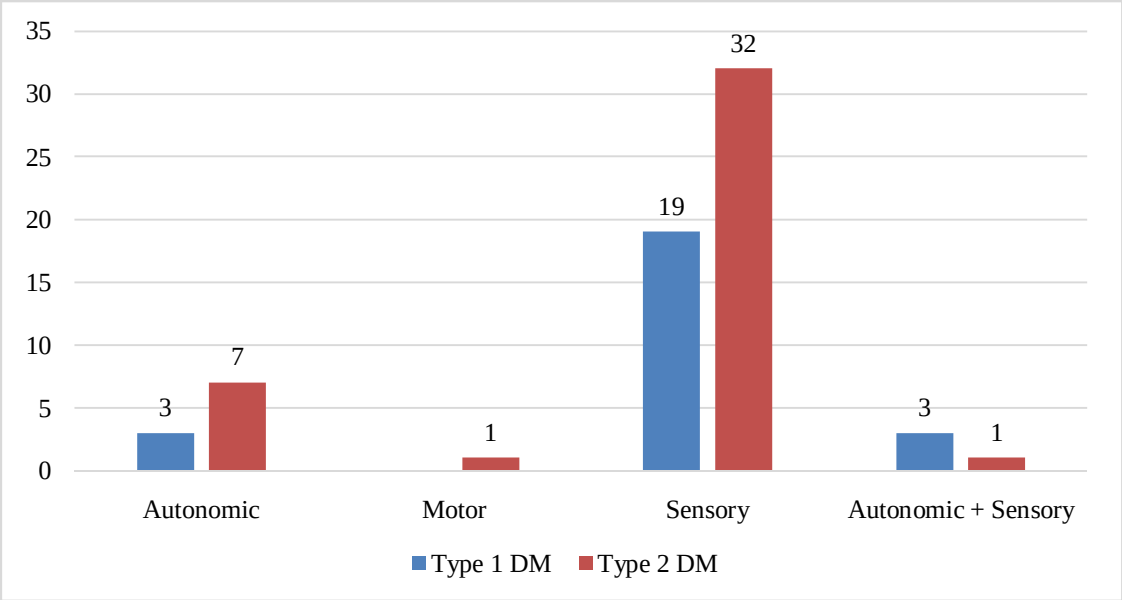


Table 21 Distribution of Neuropathy in the study population (n=200)

Neuropathy	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	25 (45.5)	41 (28.3)	66 (33)
Absent	30 (54.5)	104 (71.7)	134 (67)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 5.322 , p value: 0.021

Comments: Neuropathy was common among Type 1 than Type 2 Diabetes and this difference in distribution of neuropathy was statistically significant ($p<0.05$).

OBESITY AND HYPERLIPIDEMIA RELATED SKIN DISEASES :

ACANTHOSIS NIGRICANS :

As a marker of insulin resistance acanthosis nigricans was seen predominantly in type 2 diabetes (6.3%) than type 1 diabetes patients (7.2%)

Table 22 Distribution of Acanthosis nigricans in the study population (n=200)

Acanthosis nigricans	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Present	3 (6.3)	10 (7.2)	13 (6.5)
Absent	51 (92.7)	136 (93.8)	187 (93.5)
Total	55 (100)	145 (100)	200 (100)

p value: 0.785

Comments: Only 3 subjects were diagnosed with Acanthosis nigricans among Type 1 Diabetes while 10 cases reported with Acanthosis nigricans among the Type 2 diabetics but this difference was not statistically significant ($p>0.05$).

Table 23 Distribution of Acrochordon in the study population (n=200)

Acrochordon	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Present	11 (20)	15 (10.3)	26 (13)
Absent	44 (80)	130 (89.7)	174 (87)
Total	55 (100)	145 (100)	200 (100)

p value: 0.070

Comments: Acrochordon was common among Type 1 than Type 2 Diabetes but this difference in distribution of acrochordon was not statistically significant ($p>0.05$).

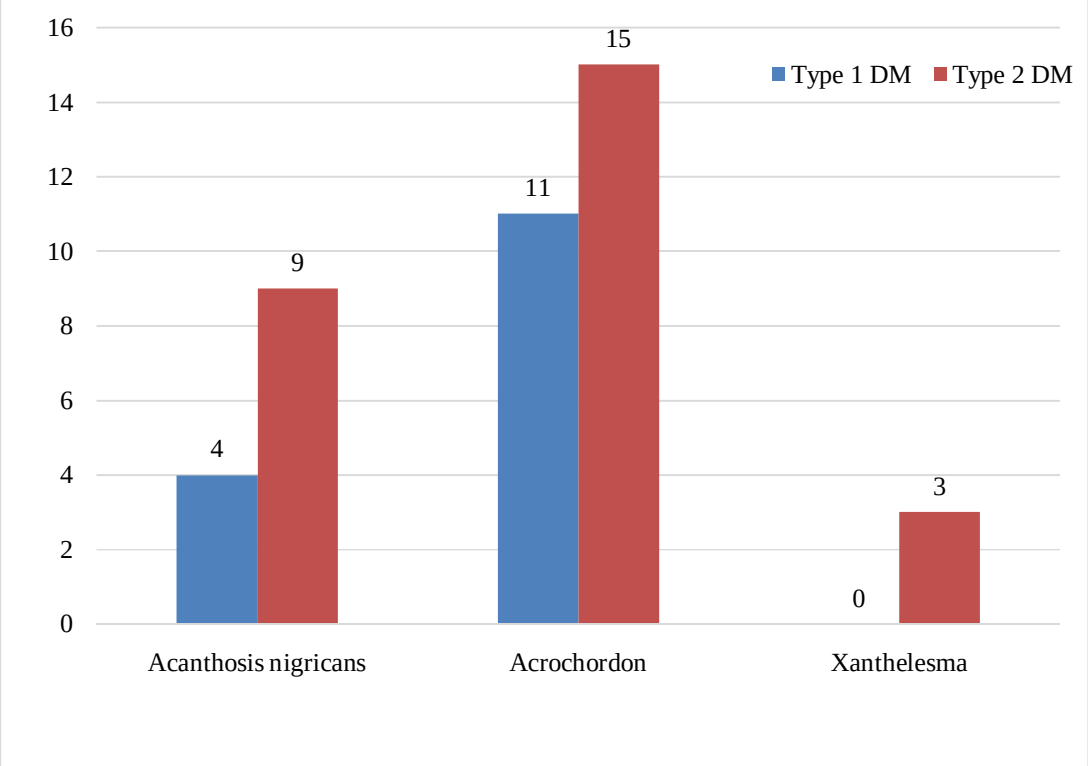
XANTHELASMA :

Three of NIDDM patients were found to have xantheslasma presenting as yellowish plaques over upper eyelid. Two of the three patient had abnormal lipid levels.

Table 24 Distribution of Obesity and hyperlipidemia lesions in the study population (n=200)

Lesion	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Acanthosisnigricans	4 (7.3)	9 (6.2)	13 (6.5)
Acrochordon	11 (20)	15 (10.3)	26 (13)
Xanthelesma	0 (0)	3 (2.1)	3 (1.5)

Chart 12: Distribution of Obesity and hyperlipidemia lesions (n=200)



GRANULOMATOUS SKIN DISORDERS :

Three cases of granuloma annulare two in type 2 diabetes group and one in the other. One case in IDDM and one case in NIDDM were generalized type of GA. Histopathological examination of the lesion showed interstitial type of necrobiotic granuloma in upper and mid dermis. One NLD case was seen in our study which was consistent with the histopathological findings.

Table 25 Distribution of granulomatous disorders in the study population (n=200)

Granulomatous disorders	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Granuloma annulare	1 (1.8)	2 (1.4)	3 (1.5)
Necrobiosis lipoidica	0 (0)	1(0.7)	1(0.5)

STIFF SKIN AND JOINTS :

Cheiroarthropathy characterized by waxy tight skin on the backs of the hands and limited joint mobility (‘prayer sign’) was seen in both type 1 and 2 diabetes individuals. It is a measure of underlying microvascular changes neuropathy and retinopathy. It is demonstrated by inability to approximate the two palms with hands pressed together and fingers separated in extension called the “PRAYER SIGN” . Finger pebbles was not seen in our study group.

Scleredema diabeticorum characterized by ill defined induration of the skin on the neck and upper back was seen in two of NIDDM patients with mean duration of diabetes around 19 years.

Table 26 Distribution of stiff skin & joint disorders in the study population (n=200)9

stiff skin & joint disorders	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Cheiroarthropathy	1 (1.8)	1 (0.7)	2 (1)
Scleredema diabeticorum	0 (0)	2 (1.4)	2 (1)

DERMATOSES ASSOCIATED WITH DIABETES

PRURITUS:

Pruritus was seen in 11% of our study population. Truncal pruritus in association with autonomic neuropathy were found in 12 patients thus was found in 6% of our study. Other systemic diseases were ruled out. Anogenital pruritus were found be in prevalence of 3.4% in type 2 and 9.1% in type 1.

Table 27 Distribution of Pruritus in the study population (n=200)

Pruritus	**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Anogenital	5 (9.1)	5 (3.4)	10 (5)
Truncal	4 (7.3)	8 (5.5)	12 (6)
Absent	46 (83.6)	132 (91)	178 (89)
Total	55 (100)	145 (100)	200 (100)

Chi-square value: 2.989 , p value: 0.224

Comments: Pruritus was common among Type 1 than Type 2 Diabetes but this difference in distribution of Pruritus was not statistically significant ($p>0.05$).

Table 28 Distribution of other skin lesions frequently associated with Diabetes in the study population (n=200)

skin lesions		**Type 1 DM N (%)**	**Type 2 DM N (%)**	**Total N (%)**
Vitiligo		7 (12.7)	4 (2.8)	11 (5.5)
Psoriasis		0 (0)	6 (4.1)	6 (3)
Lichen Planus		2 (3.6)	1 (0.7)	3 (1.5)
Pretibial myxedema		0 (0)	1 (0.7)	1 (0.5)
Perforating dermatoses		0 (0)	1 (0.7)	1 (0.5)
Macular amyloidosis		1 (1.8)	2 (1.4)	3 (1.5)
Lichen amyloidosis		0 (0)	1 (0.7)	1 (0.5)
Diabetic bulla		1 (1.8)	3 (2.1)	4 (2)
Cherry angiomas		0 (0)	2 (1.4)	2 (1)
Bullous pemphigoid		0 (0)	1 (0.7)	1 (0.5)
Associated Nail changes	Leukonychia	0 (0)	3 (2.1)	3 (1.5)
	Plate thickening	0 (0)	1 (0.7)	1 (0.5)
	Onychomadesis	0 (0)	1 (0.7)	1 (0.5)

TREATMENT RELATED SKIN DISORDERS :

Insulin induced lipoatrophy and keloid were found more common than OHA related drug reactions.

Table 29 Distribution of treatment related skin disorders in the study population (n=200)

Treatment	Type	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Insulin	Lipoatrophy	1 (1.8)	1 (0.7)	2 (1)
	Keloid	2 (3.6)	0 (0)	2 (1)
OHA	Photosensitivity	0 (0)	1 (0.7)	1 (0.5)
	Fixed drug eruptions	0 (0)	1 (0.7)	1 (0.5)

Chart 13: Treatment related skin disorders in the study population (n=200)

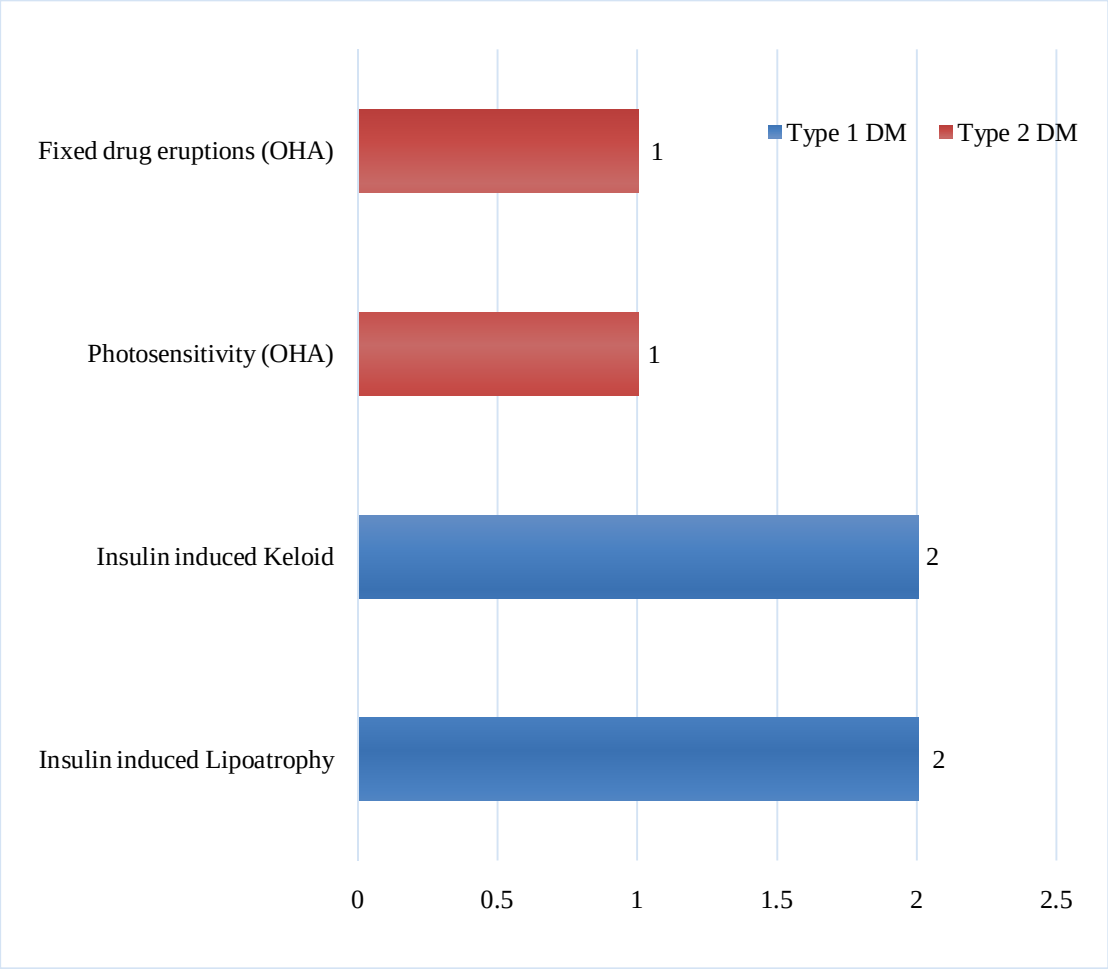


Table 30 Distribution of skin lesions in various categories in the study population (n=200)

Skin lesions	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Infection	41 (74.5)	100 (69)	141 (70.5)
Lesions due to Vascular damage	5 (9.1)	14 (9.7)	19 (9.5)
Neuropathy	25 (45.5)	41 (28.3)	66 (33)
Hyperlipidemia associated lesions	12 (21.8)	19 (13.1)	31 (15.5)
Granulomatous skin lesions	1 (1.8)	3 (2.1)	4 (2)
Stiff skin & Joints	1 (1.8)	3 (2.1)	4 (2)
Treatment related lesions	3 (5.5)	3(2.1)	6 (3)
Skin lesions associated with diabetes	21 (38.2)	41 (28.3)	62 (31)

Chart 14: Distribution of skin lesions in various categories (n=200)

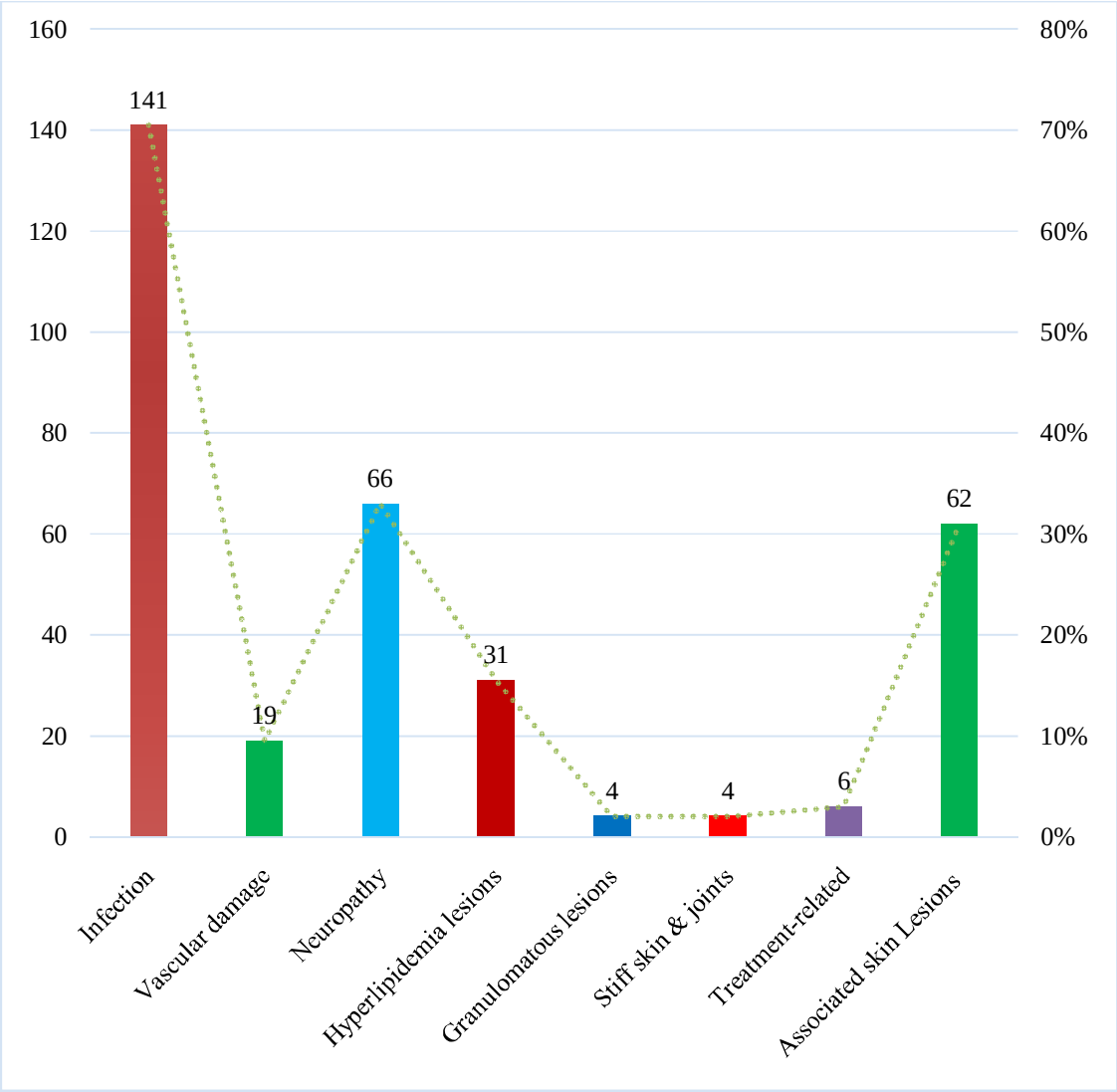


Chart 15: Distribution of skin lesions in various categories (n=200)

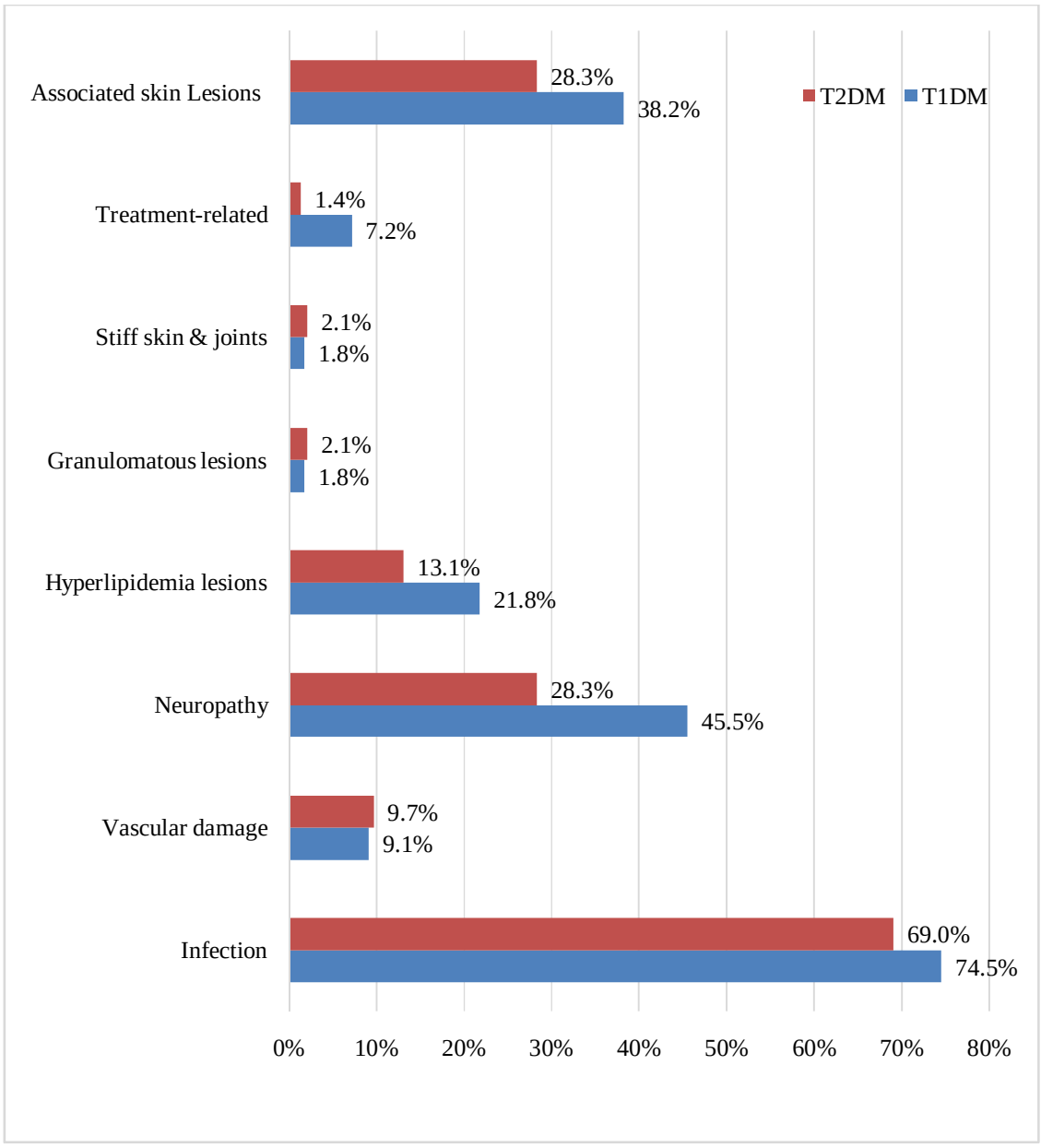


Table 31 Distribution of study population according to number of skin lesions (n=200)

Skin lesions	Type 1 DM N (%)	Type 2 DM N (%)	Total N (%)
Absent	1 (1.8)	1 (0.7)	2 (1)
One lesion	13 (23.6)	73 (50.3)	86 (43)
Two lesions	26 (47.3)	63 (43.4)	89 (44.5)
Three lesions	15 (27.3)	8 (5.5)	23 (11.5)
Total	55 (100)	145 (100)	200 (100)

More than one lesion / dermatoses was found in 56% of our study population.

Chart 16: Number of skin lesions per patient (n=200)

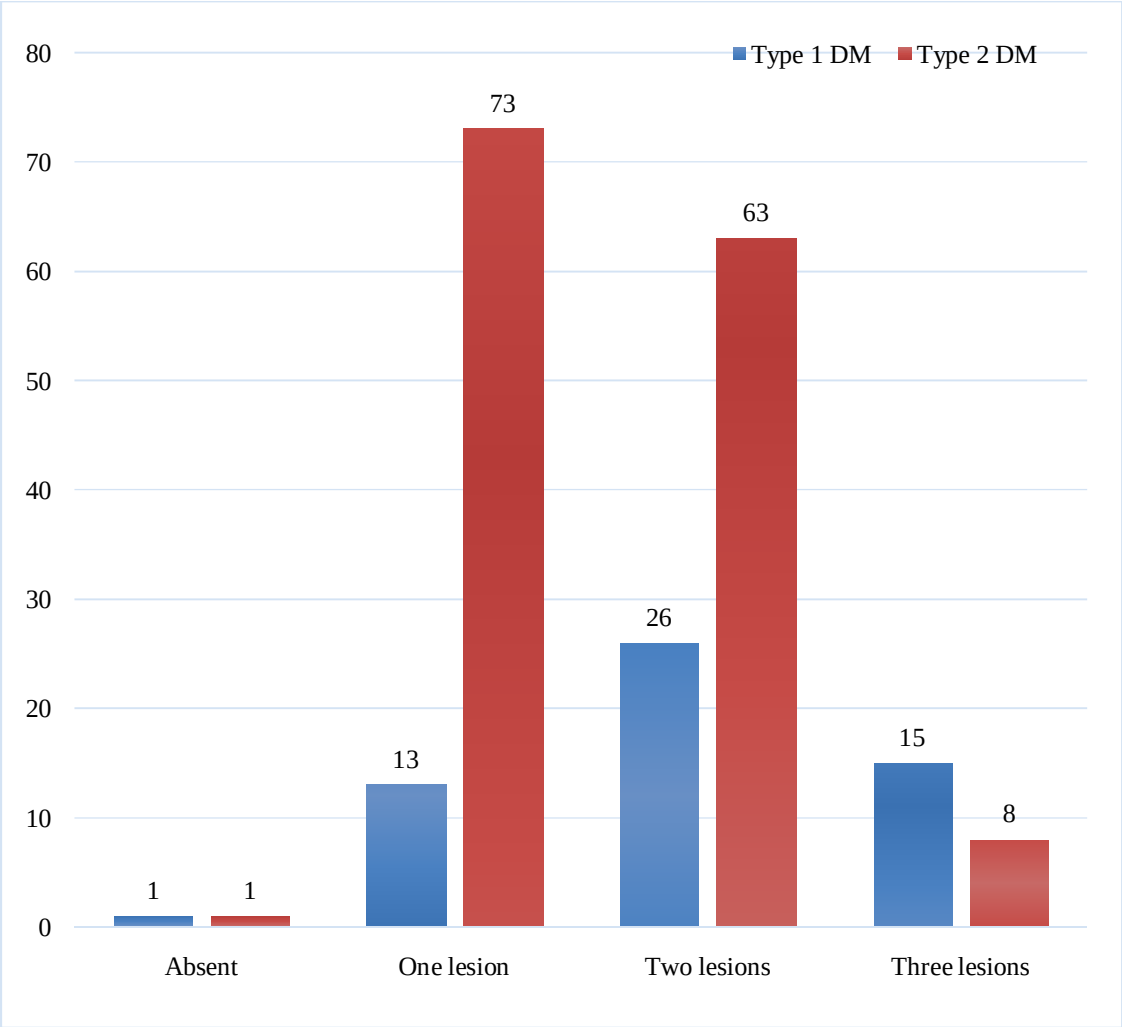


Table 32 Relationship between duration of Diabetes and occurrence of infection (n=200)

Infection	Mean Duration	Std. Deviation	p value	95% confidence interval
Present	6.500	4.5152	<0.001	1.46 to 3.98
Absent	3.778	2.9263		

Comments: Subjects with infection had a higher mean duration of Diabetes than subjects without infection and this difference in mean duration of disease was statistically significant.

Table 33 Relationship between duration of Diabetes and occurrence of Lesions due to vascular damage (n=200)

Vascular damage	Mean Duration	Std. Deviation	p value	95% confidence interval
Present	7.763	5.6969	0.027	0.263 to 4.302
Absent	5.480	4.0725		

Comments: Subjects with vascular damage had a higher mean duration of Diabetes than subjects without vascular damage and this difference in mean duration of disease was statistically significant.

Table 34 Relationship between duration of Diabetes and occurrence of Lesions due to neuropathy (n=200)

Neuropathy	Mean Duration	Std. Deviation	p value	95% confidence interval
Present	7.229	5.0095	<0.001	1.052 to 3.519
Absent	4.943	3.6757		

Comments: Subjects with Neuropathy had a higher mean duration of Diabetes than subjects without Neuropathy and this difference in mean duration of disease was statistically significant.

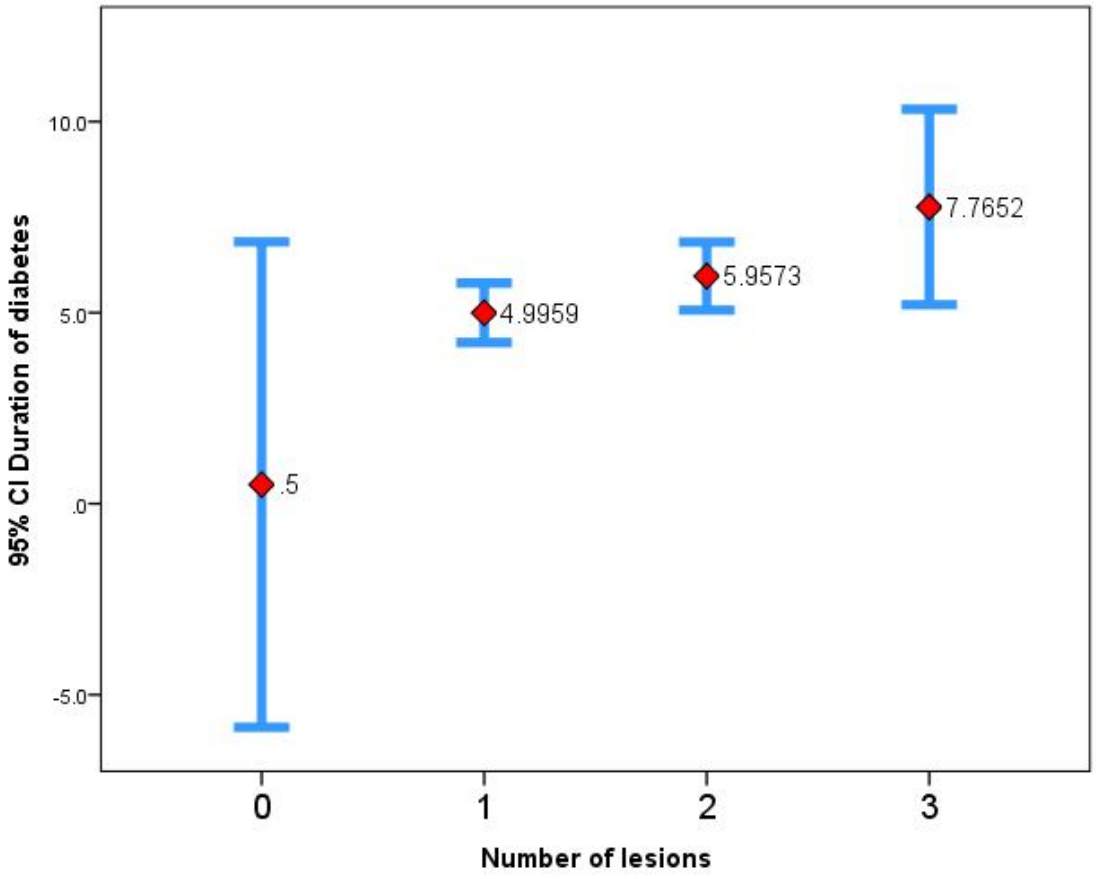
Table 35 Correlation between duration of Diabetes and Number of skin Lesions (n=200)

Number of lesions	N	Mean	Std.deviation
0	2	0.500	0.7071
1	86	4.996	3.6264
2	89	5.957	4.2248
3	23	7.765	5.9137
Total	200	5.697	4.2881

Pearson's correlation: 0.219 p value: 0.001

Comments: There was a positive linear relationship between number of lesions and mean duration of Diabetes as found by pearson's correlation. Hence as the duration of Diabetes increases, the number of skin lesions will also tend to rise.

Chart 17: Correlation between duration of Diabetes and Number of skin Lesions (n=200)



Colour Plates

Figure 1: Tinea facieii

Figure 2: KOH Wet mount of Dermatophyte shows long hyaline branched septate hyphae with arthrospores

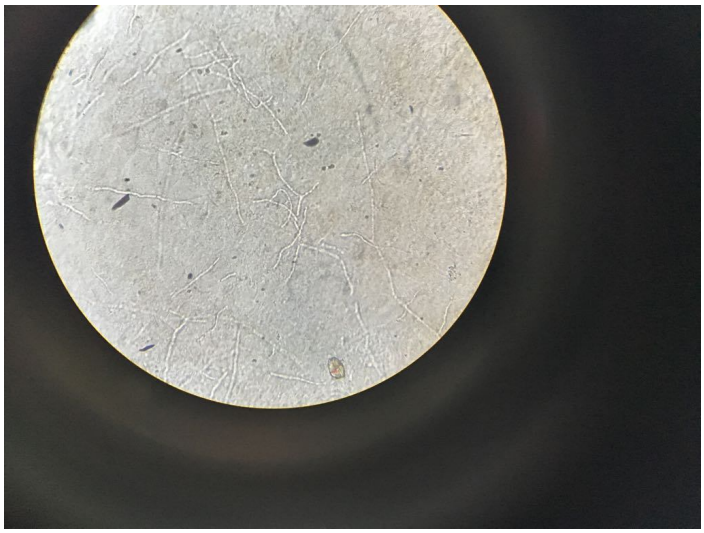


Figure 3: Oral Candidiasis

Figure 4: Gram stain shows budding yeast cells and blastospores

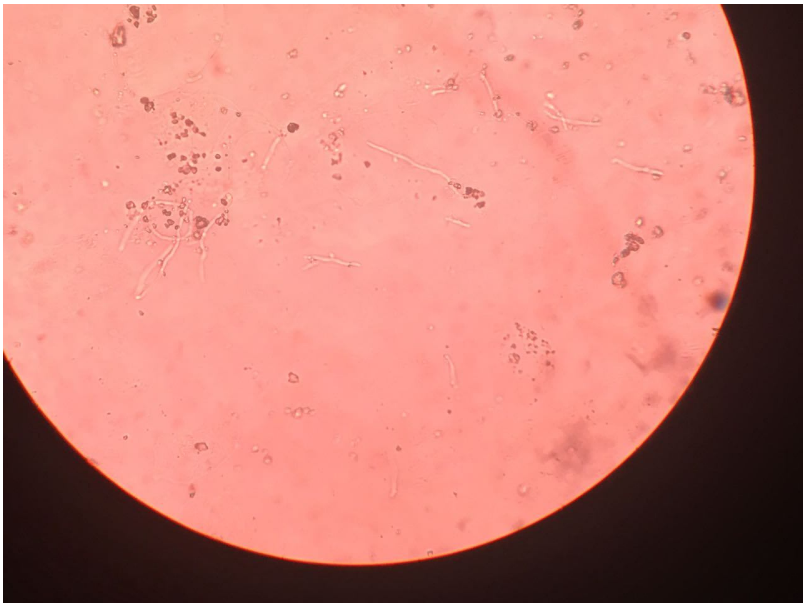


Figure 5: KOH Wet mount of Pityriasis versicolor shows short straight angulated hyphae with blastospores

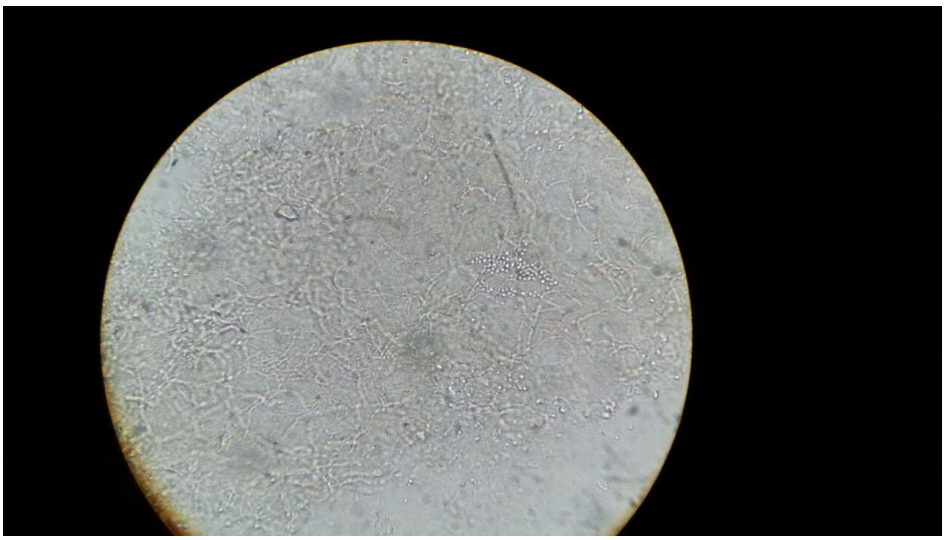


Figure 6: MUCOR MYCOSIS

Figure 7: KOH Wet mount shows broad ribbon like non septate hyphae with branches at right angle s/o Mucor mycosis

Figure 8: Culture shows grayish white flat colonies with wooly texture

Figure 9: HPE shows broad ribbon like non septate hyphae

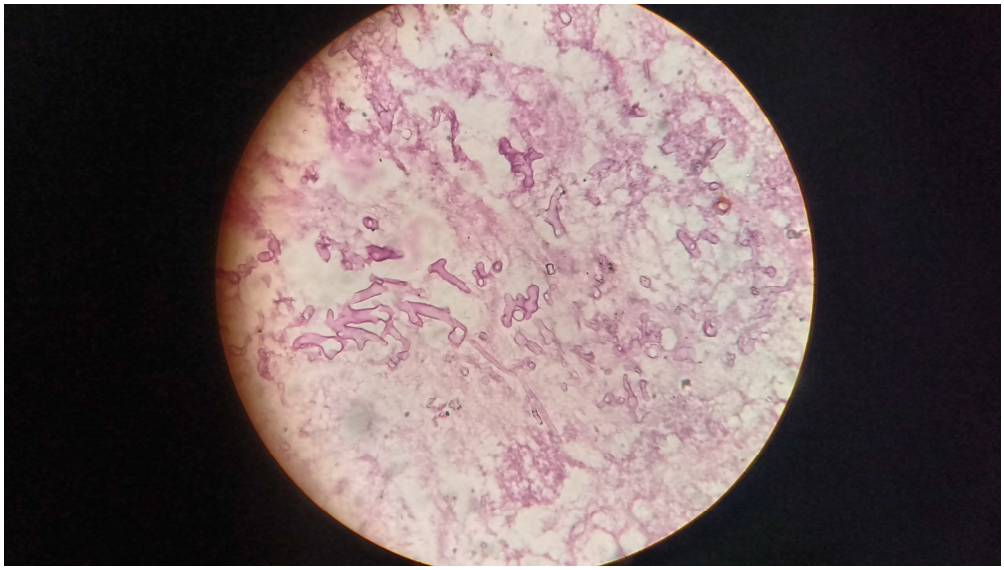


Figure 10: Cellulitis

Figure 11: Erysipelas

Figure 12: Keratolysis punctata

Figure 13: Herpes zoster

Figure 14: Tzanck smear showing multinucleated giant cell

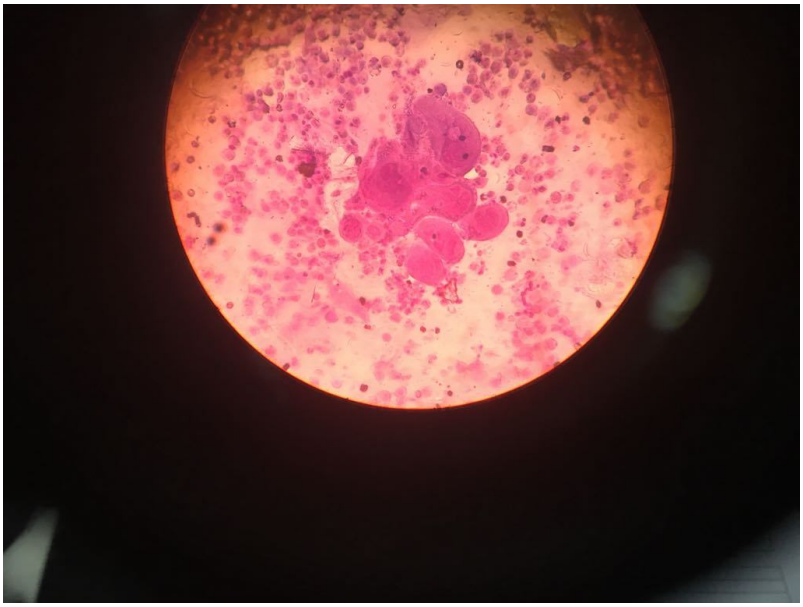


Figure 15: Verucca vulgaris

Figure 16: HPE of Verucca

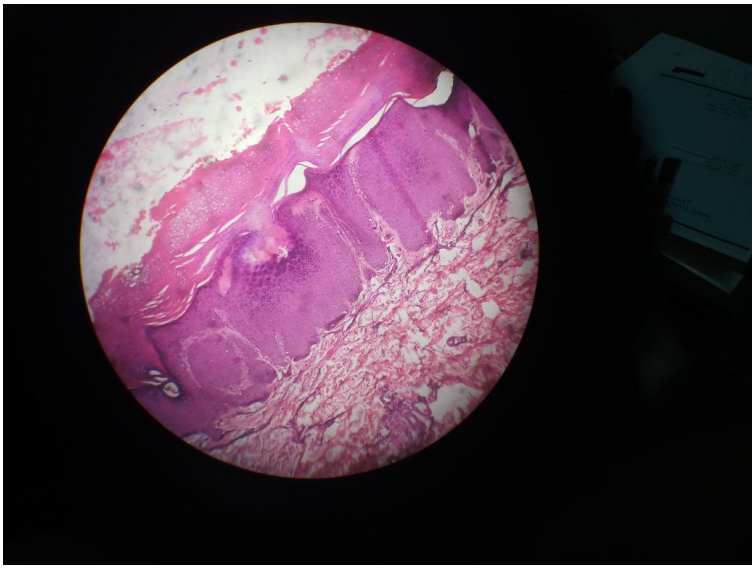


Figure 17: Trophic ulcer with distally displaced plantar fat pads

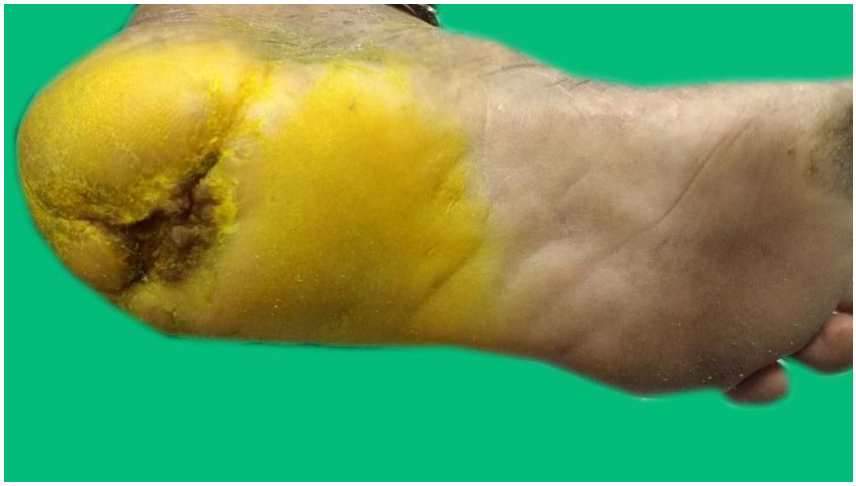


Figure 18: Hammer toes

Figure 19: Acanthosis nigricans with multiple skin tags

Figure 20: HPE of Acanthosis nigricans

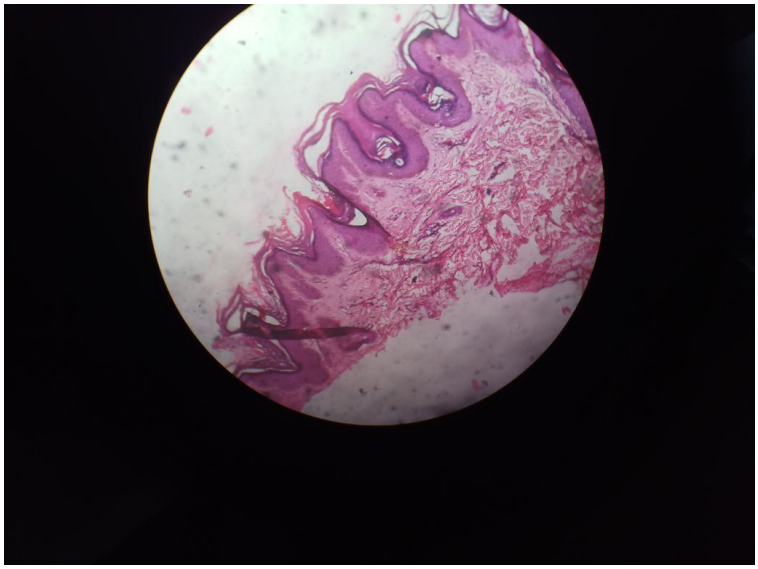


Figure 21: Xanthelasma

Figure 22: Granuloma annulare

Figure 23: HPE of Granuloma annulare

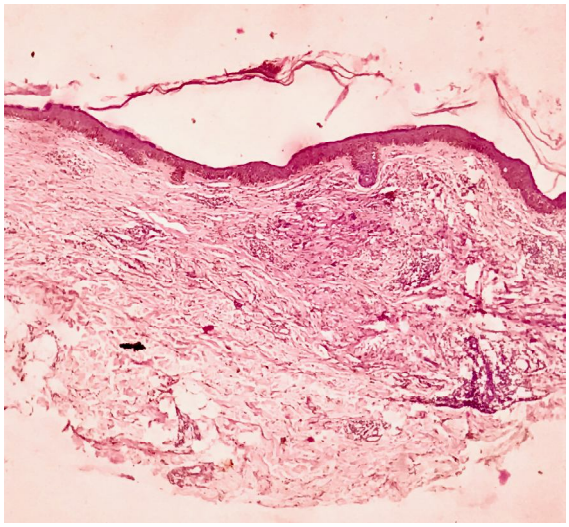


Figure 24: Necrobiosis lipoidica

Figure 25: HPE of Necrobiosis lipoidica shows sclerosis and infiltrate in upper and mid dermis

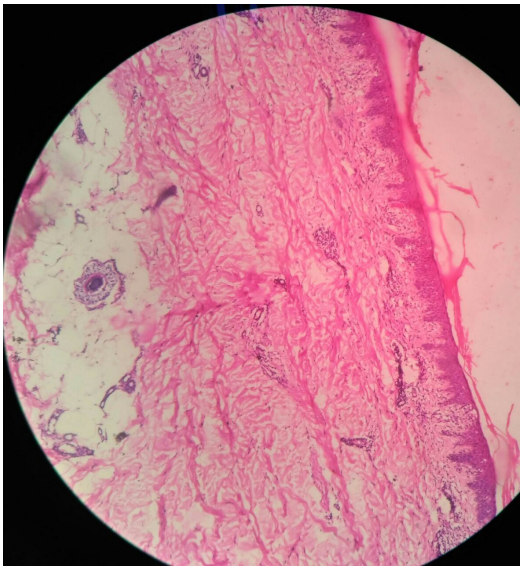


Figure 26: Cheiroarthropathy

Figure 27: Scleredema diabeticorum

Figure 28: Diabetic bulla

Figure 29: HPE of Diabetic bulla

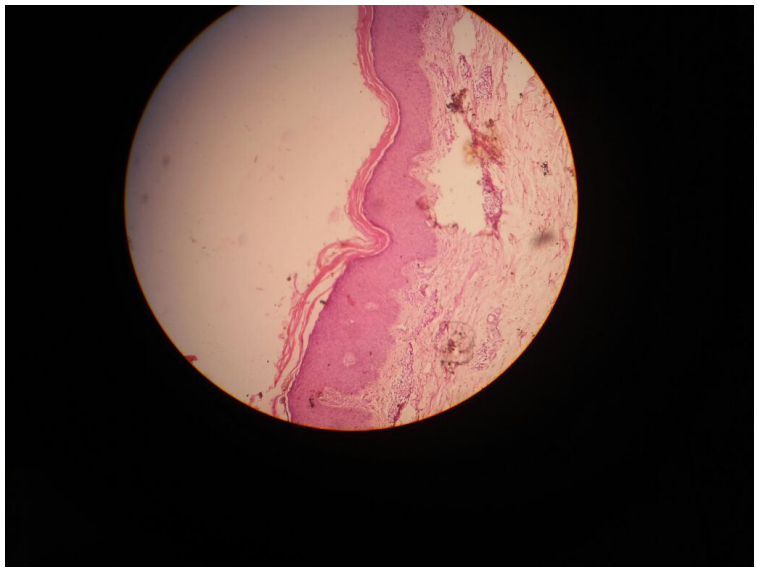


Figure 30: Perforating folliculitis

Figure 31: HPE of Perforating folliculitis

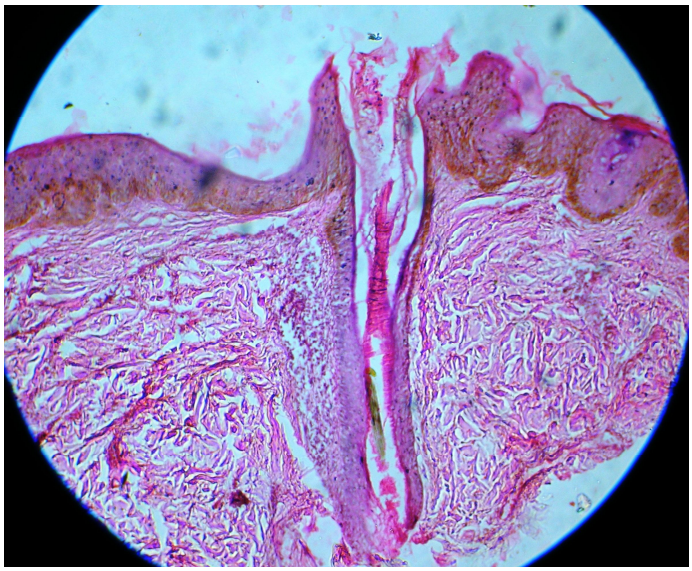


Figure 32: Vitiligo

Figure 33: Alopecia areata

Figure 34: Oral lichen planus

Figure 35: Pretibial myxedema

Figure 36: Keloid

Figure 37: Fixed drug eruption

Figure 38: Beau's lines

Figure 39: Diabetic dermopathy

DISCUSSION

This study was conducted in the outpatient clinics of Department of Dermatology and Institute of Diabetology at Rajiv Gandhi Government General Hospital, Chennai. Diabetes mellitus is the most common metabolic disorder in which skin is the most unique organ to be involved.

AGE DISTRIBUTION

Type 1 DM is usually seen in cases less than 30 years of age and occurs mostly in children and the incidence is highest among the 10 to 14 years old age groups, whereas type 2 DM has a gradual onset and occurs mainly in the middle-aged and elderly[101].

In our study Type 1 Diabetes was commonly found in a younger age group of 21 to 30 years (54.5%) whereas Type 2 Diabetes was commonly seen in middle age group 41 to 50 years (39.3%). In both types 41 to 50 years(28.5%) is the most common age group seen which is comparable to Bhat et al.,[100]Mahajan et al.,[98]and Roshini vahora et al[102] where they found that the most common age group to be of 41 - 50 years in 33.3%, 33%, 40% of the patients respectively in their studies.

GENDER INCIDENCE:

In our study females show slight predominance over males (51% and 49%) and is correlating with the previous studies done by Mahajan[98] et al study in which females show preponderance over males (58% and 42%) and it is not correlating

with Abhisheck goel et al[103] (46% and 54%) and Roshini vahora et al[102] (49% and 51%)

INCIDENCE:

Most studies have shown the incidence of cutaneous disorders associated with diabetes to be between 30% and 71%.[1,2] Mahajan et al[98] in their study found that 64% of patients had cutaneous manifestations. Nigam and Pande[99] in a study on the pattern of dermatoses in 200 diabetics found that 61% had cutaneous dermatoses. Bhat et al[100]in a study of the cutaneous manifestation of diabetes mellitus in 150 diabetics found it to be in 66% of the cases and 21.3% of the controls.

TYPE OF DIABETES :

Our study comprising of 200 diabetics,145 patients (72.5%) were NIDDM and 55 patients (27.5%) were IDDM differ from the study made by Mahajan et al[98] and Bhat et al[100] where they had type 2 DM in 98% and 97.7% respectively. In our study we could not find any secondary diabetes or gestational diabetes patients as in Mahajan et al[98] and Bhat et al[100]

DURATION:

Most of the patients in the study of Bhat[100] et al and Ahmed[104]et al had mean duration of DM about 10 years in most of their patients. Our study showed

duration of about 5.2 years in IDDM and 5.9 years in NIDDM as mean duration which is also statistically significant.

NUMBER OF SKIN LESIONS/DISORDERS :

56% of patients show more than one lesion in present study which is correlating with the study done by Roshini et al[102] (44%) and differs from Abhisheck goel et al(80%)[103]

CUTANEOUS INFECTIONS :

Cutaneous infections occur in 70.5% of patients in our study. This is similar to the observation done by Naheed et al[105] (62.2%) of diabetics, Mahajan et al[98] (54.69%) and Baloch[106]et al (72%)

Fungal Infections :

In our study we found fungal infections were most common(59.5%) out of which candidiasis(28%) as the most common fungal infections. This is in concordance with Mahajan et al[98]where fungal infections constitutes 59% out of which candidiasis(30.4%) is the most frequent infections. Vulvovaginal candidiasis was most seen type in females while males had balanoposthitis as common type. We found that three female patients and one male patient in type 2 DM who presented with candidiasis while screening found to be diabetic.

Second most common infection was found to be dermatophytosis(18.5%) which is somewhat equal to studies by manish et al[107](14%)

Bacterial Infections :

We observed in our study bacterial infections(24.5%) as the next common infection. This is found to be in less prevalence than in Mahajan et al[98](34%) and Rao et al(36%)[108].

We noted that erythrasma(8%) was the next common bacterial infection. This is same as that of observations made by Rao et al.[108] (6%)

MANIFESTATIONS DUE TO VASCULAR CHANGES :

In our study we found that 7% of diabetics had leg ulcer as the most common lesion due to vascular damage. Leg ulcer(7%) was found to be common in type 1 DM which is more when compared to Rao et al(3%)[108] and less than Nigam et al[99](12.9%)

Diabetic dermopathy was seen in 3% by Nigam and Pande et al[99], in 7% by Mahajan *et al*[98] in 4.2% by Ahmed *et al.*,[104]and 11.3% by Bhat *et al*[100].In our study we found only one case diabetic dermopathy(0.5%) which is very much less than the above studies.

Sudden loss of perfusion in a already compromised microcirculation results in wet gangrene of the foot. In our study we found a 44 year male patient with

gangrene of the foot (0.5%) in type 2 DM group who had duration of about 3 years. This percentage is found to be less when compared to Rao et al (2%)[108]

We could find nail changes such as beau's lines and pterygium in 2% of our study population.

Rubeosis has been reported in 3 - 59% of the diabetics[11.] But in our study we could not find any patients with rubeosis probably due to the dark skin of Indians.

NEUROLOGICAL CHANGES :

Neuropathy was observed in 45.5% among IDDM and 28.3% among NIDDDM thus in total around 33% patients in this study population which is close to 35 – 62% in previous studies[110]. It is more when compared to Mahajan et al[98](12.5%). The sensory neuropathy (77.3%) was noted to be in common in both type of diabetes.

OBESITY AND HYPERLIPIDEMIA RELATED SKIN DISEASES :

Acanthosis nigricans and acrochordons are established cutaneous markers of diabetes.[8] We observed acrochordons in 13% of study population which is in concordance to Nigam et al[99](12.3%) but less when compared to Abhishek et al(32%)[103]

Acanthosis nigricans is usually seen in insulin resistance situations such as type 2 DM, obesity, and total lipodystrophy.[111] We noted acanthosis nigricans in

6.5% of our patients which is equal to 5.3% in Bhat *et al* [100] , 4.7% in Mutairi *et al.*,[111] but less when compared to 3% in Mahajan *et al*[98]and 2.8% in Ahmed *et al.*[104]

Xanthelasma was observed in 1.5% of study population. This is similar to Nigam et al[99]and Ahmed et al[104] study.

GRANULOMATOUS DISORDERS :

Granuloma annulare was observed in 1.5% of our study population. It is a necrobiotic disorder [11] usually seen in children and young adults.[8] Though the association of granuloma annulare with diabetes is not clear[11] various studies show 40% of generalized GA is associated with Diabetes mellitus.

Necrobiosis lipoidica (NL) is also a necrobiotic disorder[106] found in the legs as the primary site. When NL is seen in other areas than the lower legs, the patient is less likely to have diabetes mellitus.[8] Nerobiosis lipoidica occurs in 0.3-1.6% of diabetics, but can occur in non-diabetic conditions also.[8] In our study, NLD was seen in one patient(0.5%) in type 2 diabetes group with the duration of diabetes about 7 years which is similar to the findings made by Foss et al[112] and Nigam et al.[99]

As granuloma annulare, and necrobiosis lipoidica were observed only in a few cases, the association between these diseases and diabetes could not be ascertained in this study.

STIFF SKIN AND JOINTS :

In our present study we noted two cases of each in cheiroarthropathy and scleredema diabeticorum. Thus we are found each of them in 1% of our study. This is very similar to the studies done by Mahajan et al[98](0.9%)

DERMATOSES ASSOCIATED WITH DIABETES :

Associated dermatoses was found in 20% of our study population of which pruritus was present in 11% of our study. Truncal pruritus was seen in 6% and anogenital pruritus in 5%. Generalized pruritus is not specifically associated with diabetes mellitus, although pruritus vulvae may be the presenting symptoms of diabetes.[109] Pruritus was reported in 15.6% of the diabetics by Mahajan *et al*[98]and in 4.5% by Nigam and Pande.[99]

Bullous diabeticorum or idiopathic bullae of diabetes are distinct markers of diabetes. It is seen in 2% of our study as exactly seen in Abhishek et al[103] and more when compared to Nigam et al[99] (1%) and Ahmed et al(0.6%)[104]

Vitiligo and psoriasis were present in 5.5% and 3% of our study of which vitiligo seen more in IDDM patients which is same as that of Ahmed et al(5.5%)[104] and Foss et al(2.5%)[112]. We found only one case of each in perforating dermatoses, pretibial myxedema, bullous pemphigoid. Their association with diabetes could not be ascertained. The patient who had perforating folliculitis was also found to have diabetic nephropathy.

TREATMENT RELATED SKIN DISORDERS :

Cutaneous complications of diabetes therapy was observed in 3% of our study group. Adverse reactions to insulin in form of lipoatrophy and keloid were observed in only 2% of all patients treated with insulin. Photosensitivity and FDE to OHA were found in 1% of our study group. This is less when compared to Mahajan et al.[98] (3%)

LIMITATIONS OF THE STUDY :

1. As this study has been carried out over a limited period of time it was not large enough to be of reasonable precision.
2. It is a hospital based study the frequency of cutaneous manifestations may not reflect the actual population of our community.
3. Few dermatoses that were found to be more associated in diabetes in various studies cannot be ascertained as they were observed in only a few number in our study.
4. Secondary and gestational diabetes with cutaneous features was not found in our study which hinders to know the exact prevalence of dermatoses in diabetes in our area.
5. Investigations such as HbA1c, antibody testing which improves the specificity of diagnosing diabetes could not be done in our hospital due to resource constraints.
6. Histopathological examination of skin conditions were done only in lesions with diagnostic ambiguity.

STRENGTH OF THE STUDY:

Study population was 200 which is large enough to know the prevalence of skin manifestations in our community to a certain extent.

CONCLUSION:

In a prospective observational study consisting of 200 diabetics with cutaneous features attending our hospital RGGGH, Chennai we found that,

- Most of the dermatoses associated with diabetes were found in age group of 41 to 50 years of age.
- In our study comprising of 200 diabetics,145 patients (72.5%) were NIDDM and 55 patients (27.5%) and females show slight predominance over males (49% and 51%)
- Mean duration was found to be of about 5.2 years in IDDM and 5.9 years in NIDDM.
- As the duration of diabetes increases the number of dermatoses/lesions, co-morbidities and complications were also found to increase.
- Infections, neuropathy, pruritus and associated dermatoses were observed to be the common dermatoses in the same order.
- Cutaneous infections formed the largest group in our study correlating in almost all various studies.
- Among infections fungal infections are the most common infection. Candidiasis is found to be the early marker of undiagnosed diabetes.
- Vulvovaginal candidiasis was most seen type in females while males had balanoposthitis as common type.

- Totally around 33% patients in this study population was noted to have neuropathy and sensory neuropathy. (77.3%) that was noted to be in common in both type of diabetes.
- Acrochordon is found to be the most common obesity/ hyperlipidemia related disorders.
- Among granulomatous disorders, granuloma annulare(1.5%) was noted to be the most common.
- In dermatoses associated with diabetes we observed pruritus (11%) as the most common one.
- Vitiligo, Oral lichen planus, Acanthosis nigricans, Granuloma annulare were seen exclusively in IDDM group. Psoriasis, Acrochordons, Localized cutaneous amyloidosis were limited more to the NIDDM group.
- Thus emphasizing the importance of the physicians to be made aware of cutaneous manifestations in diabetes mellitus where the ignorance of skin manifestations in diabetes or improper treatment may make the condition worse.
- The early detection and early treatment of common skin manifestations in diabetes will prevent further complications or ineffectiveness due to treatment which will help these patients to lead a normal life.

REFERENCES

1. Halprin KM, Ohkawara A. Glucose entry into the human epidermis, I: the concentration of glucose in the human epidermis. J Invest Dermatol1967;49:559–560.
2. Yosipovitch G, Hodak E, Vardi P, et al. The prevalence of cutaneous manifestations in IDDM patients and their association with diabetes risk factors and microvascular complications. Diabetes Care 1998; 21:506–509.
3. International Diabetes Federation. IDF Diabetic Atlas 7th Edition.
4. Tripathy et al. Diabetol Metabolic Syndrome (2017) 9:8.
5. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unni krishnan R, et al. Prevalence of diabetes and pre-diabetes (impaired fasting glucose and/ or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research India diabetes (ICMR-INDIA) study. Diabetologia. 2011;54(12):3022.
6. Mohan V. Why are Indians more prone to diabetes? J Assoc Physicians India. 2004;52:468–74.
7. Perez MI, Kohn SR. Cutaneous manifestations of diabetes mellitus. J Am Acad Dermatol1994; 30: 519–31.
8. Huntley AC. The cutaneous manifestations of diabetes. J Am Acad Dermatol1982: **7**:427–55.

9. Kalkoff K W. Diabetes and the skin. Hexagon 1982;9:1–10.

10. Braverman IA.Skin Signs of Systemic Disease, 3rd edn. Philadelphia: Saunders,1998: 457–64.

11. Ferringer T, Miller OF III. Cutaneous manifestations of diabetes mellitus. DermatolClin2002;20: 483–92.

12. Boyne M, Dobs AS, Krasner AS, Provost TT. Evaluation and treatment of endocrine disorders. In: Provost TT, Flynn JA, eds. Cutaneous Medicine. Cutaneous Manifestations of Systemic Disease. Hamilton, Ontario: B.C. Decker, 2001: 413–51.

13. Cox NH. Diabetes and the skin: an update for dermatologists. Expert Rev Dermatol2007; 2: 305–16.

14. American Diabetes Association Standards of Medical Care in Diabetes. Classification and diagnosis of diabetes. Diabetes Care 2017; 40 (Suppl. 1): S11-S24.

15. Huntley AC, cutaneous manifestations of diabetes mellitus, skin signs of internal disease. Dermatology clinics, July 1989, volume 7. No.3, 531.

16. Endocrinol Metab Clin North Am. 2013 Dec ;13(4) 869-98.

17. Rook's Textbook of Dermatology 9th edition,chapter 64.

18. Behm B, Schreml S, Landthaler M, Babilas P. Skin signs in diabetes mellitus. J Eur Acad Dermatol Venereol. 2012;26: 1203–11.

19. Joslin's Diabetes Mellitus 14thedition. Chapter 62.Page No;1049.

20. Blakytny R, Jude EB. Altered molecular mechanisms of diabetic foot ulcers. Int J Low Extrem Wounds. 2009;8:95–104.

21. Gkogkolou P, Bohm M. Advanced glycation end products: key players in skin aging? Dermatoendocrinology. 2012;4:259–70.

22. Avery NC, Bailey AJ. The effects of the Maillard reaction on the physical properties and cell interactions of collagen. Pathol Biol. 2006;54:387–95.

23. Yuen A, Laschinger C, Talior I, Lee W, Chan M, Birek J, et al. Methyl glyoxal modified collagen promotes myofibroblast differentiation. Matrix Biol. 2010;29:537–48.

24. Frykberg RG, Zgonis T, Armstrong DG, Driver VR, Giurini JM, Kravitz SR. Diabetic foot disorders. A clinical practice guideline. J Foot Ankle Surg. 2006;2006(45):S1–66.

25. Greenhalgh DG. Wound healing and diabetes mellitus. Clin Plast Surg. 2003;30: 37–45.

26. Bertheim U, Engstrom-Laurent A, Hofer PA, Hallgren P, Asplund J, Hellstrom S. Loss of hyaluronan in the basement membrane zone of the skin correlates to the degree of stiff hands in diabetic patients. Acta DermVenereol. 2002;82:329–34.

27. Wertheimer E, Trebicz M, Eldar T et al. Differential roles of insulin receptor and insulin-like growth factor-1 receptor in differentiation of murine skin keratinocytes. J Invest Dermatol 2000: 115: 24–29.

28. Benoliel AM, Kahn Perles B, Imbert J et al. Insulin stimulates haptotactic migration of human epidermal keratinocytes through activation of NF-kappa B transcription factor. J Cell Sci1997; 110: 2089–2097.

29. Tsao MC, Walthall BJ, Ham RG. Clonal growth of normal human epi-dermal keratinocytes in a defined medium. J Cell Physiol 1982; 110: 219–229.

30. Yosipovitch G, Tur E, Cohen O et al. Skin surface pH in intertriginous areas in NIDDM patients. Possible correlation to candidal intertrigo. Diabetes Care 1993; 16: 560–563.

31. Seirafi H, Farsinejad K, Firooz A et al. Biophysical characteristics of skin in diabetes: a controlled study. J Eur Acad Dermatol Venereol 2009; 23: 146–149.

32. Deborah E. Sentochik, George M. Infection and diabetes mellitus in Joslins diabetes mellitus, 13 Ronald kahn, Cordon C. Weir, Lea Febiger, 1994, chapter 47: 867-888.

33. Murphy DP: Primary Care. Am J ObstetricGynecol.

34. Hostetter MK: Perspectives in diabetes: Effects of hypergylcemia on CD and Candida albicans. Diabetes 39:271, 1990.

35. Petarka ES, Fusaro RM. Cutaneous carbohydrate studies, III: comparison of the fasting glucose content of the skin of the back, arm, abdomen and thigh. J Invest Dermatol1966;47:410–411.

36. Knight L., Fletcher J, Growth of candida albicans in saliva. Stimulation by glucose associated with antibiotics, steroids and diabetes mellitus. 1971; 123: 371-377.

37. Stone OJ, Mullins JF. Incidence of chronic paronychia JAMA 1962; 186:71-73.

38. Greene RA, Scher RK. Nail changes associated with diabetes mellitus. Dermatology 1987;16:1015–1021.

39. Goswami R, Dadhwal V, Tejaswi S et al. Species-specific prevalence of vaginal candidiasis among patients with diabetes mellitus and its relation to their glycaemic status. J Infect 2000; 41: 162–166.

40. Cates JI, Finestone A, Bogash M. Phimosis and diabetes mellitus. J Urol 1973; 110, 406–407.

41. Alteras I, Saryt E. Prevalence of pathogenic fungi in the toe-webs and toe-nails of diabetic patients. Mycopathologia1979;67:157–159.

42. Senthamil Selvi G. Chronic dermatophytosis, A clinical and etiopathological study, Ph. Dissertation, University of Madras, 1989: 274-278.

43. Joslin's Diabetes Mellitus 14th edition. Chapter 60.Page No;1020.

44. Waldor AR, Ruderman N, Diamond RD: Specific susceptibility to Mucormycosis in murine diabetes and bronchoalveolar macrophage defense against Rhizopsus. J Clin Inves 74:150- 60, 1984.

45. Rippon Jw, Zygomycosis, and medical mycology, IIIrd edition, W.B. Saunder's company, chapter 25, 1988 : 681- 713.

46. IADVL text book of dermatology

47. Gilgor S. Robert cutaneous infections in diabetes mellitus, in the skin in diabetes, edited by JE Jellinek, 1985, chapter 6 : 111-129.

48. Senthamil Selvi G., A. Kamalam, Thambiah AS, in Erythrasma, A clinical and etiopathology study, current medical practice, 1985, Vol.29,6 : 10-14.

49. Eke N : Fournier's gangrene : A review of 1726 cases. Br J Surg 87 : 718, 2000.

50. Harter D H, petersdorf R G. Bacterial meningitis and brain abscesses In Wilson JD, Braunwald K, Isselbacher KJ, et al, eds. Harrison's principles of internal medicine. Vol 2. 12th ed. New York: McGraw-Hill, 1991:2023–2031.

51. Zaky D A,Bentley D W,Lowy K, et al. Malignant external otitis: a severe form of otitis in diabetic patients. Am J Med 1976;61:298–302.

52. Orasanu G, Plutzky J. The pathologic continuum of diabetic vascular disease. J Am Coll Cardiol 2009; 53: S35–S42.

53. Levin ME. The diabetic foot Jellinek J E, editor. The skin in diabetes. 1st edition 1986. Pg 73-84.

54. Crawford F, Inkster M, Kleijnen J, Fahey T. Predicting foot ulcers in patients with diabetes: a systematic review and meta-analysis. Q J Med 2007;100(2):65–86.

55. Baur FM, Levan NE. Diabetic dermangiopathy : a spectrum including pigmented pretibial patches and necrobiosis lipiodica diabeticorum. Br. J. Dermatology 1970 : 83:528-35.

56. Melin H. An atrophic circumscribed skin lesion in the lower extremities of patients with diabetes. Acta Med Scand1964;176[Suppl 423]:1–75. 107.

57. Danowski TS, Sabeh G, Sarver ME, et al. Skin spots and diabetes mellitus. Am J Med Sci1966;251:570–575.

58. Shemer A, Bergman R, Linn S, et al. Diabetic dermopathy and internal complications in diabetes mellitus. Int J Dermatol 1998;37:113–115.

59. Ditzel J. Functional microangiopathy in diabetes mellitus. Diabetes 1968;17:388–397.

60. Clinical and Pathological Aspects of Skin Diseases in Endocrine, Metabolic, Nutritional and Deposition Disease Franco Rongioletti Bruce R. Smoller chapter Page no : 23.

61. Wilmer WA, Magro CM (2002) Calciphylaxis: emerging concepts in prevention, diagnosis, and treatment. Semin Dial 15:172–186.

62. Ohta A, Ohomori S, Mizukami T, Obi R, Tanaka Y (2007) Penile necrosis by calciphylaxis in a diabetic patient with chronic renal failure. Intern Med 46:985–990.

63. Goodman JE, diabetic anhydosis, American Journal of Medicine, 1966, 41: 831.

64. Wukich DK, Sung W. Charcot arthropathy of the foot and ankle: modern con- cepts and management review. J Diabetes Complicat 2009;23(6):409–26.

65. Schwartz RA :Acanthosis nigricans. J Am Acad dermatol31 ; 1, 1994.

66. Taskinen MR. Hyperlipidaemia in diabetes. Bailllieresclin Endocrinal Metab. 1990 4: 743-75.

67. Lever's Histopathology of the skin tenth edition chapter 26 Page no 682.

68. Mar H Jeffrey S. Necrobiosis lipoidica. JAAD, 1991, 25 : 735-748.

69. O'Toole EA, Kennedy U, Nolan JJ, et al. Necrobiosis lipoidica: only a minority of patients have diabetes mellitus. Br J Dermatol1999; 140(2):283–6.

70. Lowitt MH, Dover JS: Necrobiosis lipoidica. J Am AcadDermatol25:735, 1991 Darvay A, Acland KM, Russel-Jones R. Persistent ulcerated necrobiosis lipoidica responding to treatment with cyclosporin. Br J Dermatol1999; 141:725–727.

71. Muller SA, Winkelmann RK. Necrobiosis lipoidica diabeticorum: a clinical and pathological investigation of 171 cases. Arch Dermatol1966; 93: 272–281.

72. Dahl MV, Goltz RW. Granuloma annulare. In: Fitzpatrick TB,Eisen AZ, Wolff K, et al, ed. Dermatology in general medicine, Vol 2. 3rd ed. New York: McGraw-Hill, 1987:1018–1022.

73. Reinhard G, Lohmann F, Uerlich M, et al. Successful treatment of ulcerated necrobiosis lipoidica with mycophenolate mofetil. Acta Derm Venereol 2000; 80:312–313.

74. Haim S, Freidman – Birnbaum R, Shafir A. Generalised Granuloma annular relationship to diabetes mellitus. Br J. dermatol 1970; 83 : 302-305.

75. Goldin D, Rook A, Gairdner D. Granuloma annular in Mauriac's syndrome. Br. J. Dermatol 1975; 93;31.

76. Dahl MV, Goltz RW. Granuloma annulare. In: Fitzpatrick TB, Eisen AZ, Wolff K, et al, eds. Dermatology in general medicine, Volume 2. 3rd edition New York: McGraw-Hill, 1987: 1018–1022.

77. Huntley AC. Finger pebbles: a common finding in diabetes mellitus. J Am Acad Dermatol1986;14:612–617.

78. Starkman HS, Gleason RE, Rand LI et al. Limited joint mobility of the hands in patients with diabetes mellitus. Ann Rheum Dis 1986; 45: 130-5.

79. Cole G W et al; Scleredema diabeticorum. A common and distinctive cutaneous manifestation of diabetes mellitus. Diabetes care 6: 189, 1983.

80. Fleischmajer R et al: Scleredema and diabetes mellitus. Arch Dermatol 101: 21, 1970.

81. Yamaoka H, Sasaki H, Yamasaki H, et al. Truncal pruritus of unknown origin may be a symptom of diabetic polyneuropathy. Diabetes Care 2010; 33: 150–5.

82. Scribner M. Diabetes and pruritus of the scalp, JAMA, 1977: 237-1559.

83. Toonstra J. Bullosis diabeticorum. Report of a case with a review of the literature. J Am Acad Dermatol. 13: 799, 1985.

84. Bernstein JE et al: Bullous eruption of diabetes mellitus. Arch Dermatol 115: 324, 1979.

85. Haftek M et al: Acquired perforating dermatosis of diabetes mellitus and renal failure. J Cuta pathol 20: 350, 1993.

86. Barker JM. Clinical review: type 1 diabetes-associated autoimmunity: natural history, genetic associations, and screening. J Clin Endocrinol Metab 2006; 91(4): 1210–17.

87. Dawber RPR, Bleehen SS, Vallance-Owen J. Vitiligo and diabetes mellitus. Br J Dermatol1971;84: 600.

88. Greene RA, Scher RK. Nail changes associated with diabetes mellitus. J Am Acad Dermatol 1987; 16: 1015- 210.

89. Grant J. Arhaldt, pemphigoid, in Immuno dermatology, Dermatology clinics, Oct. 1990: 703.

90. Green wood AM, A study of skin in 500 cases of diabetes in JAMA, 1927, 89: 774-776.

91. Jellinek JE, Dermatoses reported to be more frequent in diabetes, in skin in diabetes, Lea febiger, 1985, chapter 10 ; 175-196.

92. Gilgor RS, Lazarus GS. Skin manifestations of diabetes mellitus. In: Ellenberg M, Rifkin H, eds. Diabetes mellitus: theory and practice, 3rd ed. New Hyde Park, NY: Medical Examination Publishing,1983: 879–893.

93. Murao S, Hirata K, Ishida T, et al. Lipoatrophy induced by recombinant human insulin injection. *J Intern Med* 1998;37:1031–1033.

94. Jegasothy V. Brian cutaneous complications of diabetic treatment, in skin in diabetes, edited by JE Jellinek, Lea Feibeger, 1985, 217-226.

95. Yooung RG, Stell JM, Insulin injection sites and neglected areas British Medical Journal 1981, 283 - 284.

96. Peters AL, Davidson MB. Use of sulfonyl urea agents in older diabetic patients. Clin Geriatr Med 1990; 6 : 903-921.

97. Kono T, Hayami M et al. Acarbose induced generalized erythema multiforme. Lancet 1990.

98. Mahajan S, Karanne RV, Sharma SK. Cutaneous manifestation of diabetes mellitus. Indian J Dermatol Venereol Leprol 2003;69:105-8.

99. Nigam PK, Pande S. Pattern of dermatoses in diabetics. Indian J Dermatol Venereol Leprol 2003;69:83-5.

100. Bhat YJ, Gupta V, Kudyar RP. Cutaneous manifestations of diabetes mellitus. Int J Diab Dev Ctries 2006;26:152-5.

101. Parks Textbook of Preventive and Social Medicine, 19 th ed. Jabalpur: Banarsidas bhanot Publishers; 2007. p. 327-31.

102. Roshinivahora, Sejalthakkar, Yogesh Marfatia.Department of Dermatology, Medical College and SSG Hospital, A longitudinal study in a tertiary care hospital in Gujarat Vadodara, Gujarat,.Skin, a mirror reflecting diabetes mellitus. Year : 2013 Volume : 17 Issue : 4 Page : 659-664.

103. Abhishek goyal, Sujeet Raina, Satinder S kaushal, Vikram Mahajan N and Lal Sharma, Indian Journal of Dermatology. Patterns of cutaneous manifestations in diabetes mellitus. 2010 Jan -Mar; 39–41.John D. Bancroft, Alan Stevens, Theory and Practice of histological techniques; 2nd edition; 95- 122.

104. Ahmed K, Muhammad Z, Qayum I. Prevalence of cutaneous manifestations of diabetes mellitus. J Ayub Med Coll Abbottabad 2009;21:76-9.

105. Naheed T,Akber N,Akber N, Shahzad M, Jamil S, Ali T. Skin manifestations among diabetic patients admitted in a general medical ward for various other medical problems. Pak J Med Sci 2002;18(4):291–6.

106. Baloch GH, Memon NM, Devrajani BR, Iqbal P, Thebo NK. Cuatneous manifestations of Type-II diabetes mellitus. J Liaquat Uni Med Health Sci 2008;7(2):67–70.

107. Manish N. Kadam, Pravin N. Soni, Sangita Phatale, B. Siddramappa A study of cutaneous manifestations associated with diabetes mellitus .Int J Adv Med. 2016 May;3(2):296-303.

108. Rao GS, Pai GS. Cutaneous manifestation of diabetes mellitus. Indian J Dermatol Venereol Leprol 1997;63:232-4.

109. Feringer T, Miller FO. Cutaneous manifestation of diabetes mellitus. Dermatol Clin 2002;20:483-92.

110. Peter Dyke, Joseph Melton, Epidemiology of diabetic neuropathy 1987 : 27-35.

111. Al-Mutairi N, Zaki A, Sharma AK, Al-Sheltawi M. Cutaneous manifestations of diabetes mellitus. Med Princ Pract 2006;15:427-30.

112. N T Foss; D P Polon; M H Takada Skin lesions in diabetic patients. M C Foss- Freitas Departament of Clínical Médicine. Vol. 39 No:4, Aug. 2005.

PROFORMA

NAME: AGE / SEX:

OP/IP No: OCCUPATION:

ADDRESS:

TYPE OF DIABETES :

DURATION OF DIABETES :

TYPE OF TREATMENT:

HISTORY OF :

TRUNCAL/ANOGENITAL PRURITUS

VAGINAL DISCHARGE

PHIMOSIS/BALANOPOSTHITIS

RECURRENT FUNGAL INFECTIONS(TINEA,CANDIDA,PARONYCHIA)

RECURRENT BACTERIAL INFECTIONS(INCLUDING PSEUDOMONAS)

VASCULAR LESIONS LIKE GANGRENE

NEUROPATHY,TROPHIC ULCER

DECREASED SWEATING OFLEGS,CORNS,CALLOSITIES,FISSURES

SKIN LESIONS-FLESHY GROWTH,PIGMENTATIONS IN FLEXURES

RAISED LESIONS DISCHARGING KERATINOUS PLUG

DULL RED SCALY PAPULES/SCARS IN EXTREMITIES

ERYTHEMA,SWELLING OF FACE,HAND,FEET

INDURATION OF BACK,NECK

DEFORMITY OF FOOT

WEIGHT GAIN

AUTOIMMUNE DISEASES

GENETIC DISEASES

TREATMENT RELATED COMPLICATIONS

TREATMENT HISTORY:

PAST HISTORY:

H/O PREVIOUS DIABETES STATUS

H/O CHRONIC SYSTEMIC ILLNESS

PERSONAL HISTORY :

TYPE OF DIET

GENERALEXAMINATION : PALLOR ICTERUS CLUBBING CYANOSIS PEDAL EDEMA LYMPHADENOPATHY

WEIGHT(BMI)

SYSTEMIC PULSE BP

CVS RS

P/A CNS

DERMATOLOGICAL EXAMINATION:

TRUNK :ERYTHEMA,YELLOW DISCOLORATION XEROSIS

INDURATION/SCLEREDEMA

FACE :RUBEOSIS

FLEXURES :ACANTHOSIS NIGRICANS,SKIN TAGS,INTERTRIGO

EXTREMITIES :XEROSIS

ERYTHEMA,EDEMA,ATROPHY

DIABETIC DERMOPATHY

SENSORY NEUROPATHY
AUTONOMIC NEUROPATHY
DIABETIC FOOT
DIABETIC ULCER/GANGRENE
RUBEOSIS
ERYSIPELAS/CELLULITUS
FINGER PEBBLES
DIABETIC BULLAE
DIABETIC CHEIROARTHROPATHY
DEFORMITIES

NAIL **:**PARONYCHIA-ACUTE,CHRONIC
YELLOW NAIL
ONYCHOMYCOSIS
PSEUDOMONAS NAIL INFECTION

ORALMUCOSA **:**THRUSH,CANDIDIASIS

GENITALS **:**VULVOVAGINITIS
BALANOPOSTHITIS
PHIMOSIS

INFECTIONS **:**
BACTERIAL FURUNCULOSIS,CARBUNCLE,ECTHYMA,

FOLLICULITIS,IMPETIGO,ERYTHRASMA

FUNGAL - DERMATOPHYTOSIS,CANDIDIASIS,
PITYRIASIS VERSICOLOR

VIRAL - HERPES ZOSTER,HERPES SIMPLEX

DIABETIC TREATMENT RELATED COMPLICATIONS :

INSULIN-

PIGMENTATION,INFLAMMATION,ULCER,SCAR,KELOID,LIPOHYPERTROPHY,LIPOATROPHY,DRUG REACTIONS

O.H.A - PHOTOSENSITIVITY,LICHENOID

ERUPTIONS,ECZEMATOUSREACTION,SJS

OTHER SKIN LESIONS : XANTHOMAS,XANTHELASMA
PERFORATING DERMATOSIS
GRANULOMA ANNULARE
NECROBIOSIS LIPOIDICA

ASSOCIATED DISEASES :VITILIGO
ALOPECIA AREATA
PSORIASIS
LICHEN PLANUS
HYPOTHROIDISM
BULLOUS PEMPHIGOID
CUTANEOUS AMYLOIDOSIS

CLINICAL PHOTOGRAPH NO:

INVESTIGATIONS:

HAEMATOLOGY :

Hb%

TC

DC

ESR

BLOOD SUGAR

BLOOD UREA

SERUM CREATININE

URINE ANALYSIS :

ALBUMIN

SUGAR

SKIN BIOPSY:

WET MOUNT IN KOH 10%-40% :

GRAM STAIN EXAMINATION OF SMEAR :

SPECIFIC INVESTIGATIONS :

LIPID PROFILE

GLYCOSYLATED HEMOGLOBIN

VASCULAR SURGEON OPINION(DIABETIC ULCER)

ORTHOPAEDIC SURGEON OPINION(DIABETIC FOOT)

INFORMATION SHEET

Title : SKIN DISORDERS IN DIABETES MELLITUS – A CLINICOPATHOLOGICAL STUDY

Name of investigator : **Dr. C. DURGAVATHI**

Name of the participant: **Age:** **Sex:**

Study setting : **Department of Dermatology, Madras Medical College & RGGGH, Chennai-3**

- You are invited to take part in this study. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns
- We are conducting a study on **"SKIN DISORDERS IN DIABETES MELLITUS – A CLINICOPATHOLOGICAL STUDY"** among patients attending Rajiv Gandhi Government General Hospital, Chennai
- And for that your participation may be valuable to us.
- The purpose of the study is to analyze prevalence and pattern of cutaneous manifestations in diabetes mellitus in patients attending this tertiary care center in Chennai.
- We will obtain appropriate history and conduct clinical examination of skin pertaining diabetes mellitus. Clinical photographs would be taken in all patients.
- Blood sample would be collected from all cases for routine(CBC,RFT, LFT),diabetes mellitus(FBS,PPBS) and lipid profile . Skin biopsy would be done if necessary.In case of skin biopsy it would be performed under aseptic precautions, with lignocaine as local anesthetic agent, after test dose.

- Your privacy in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.
- Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.
- The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator
Dr.C.DURGAVATHI

Date:

Signature of participant

Date:

ஆய்வு தகவல் தாள்

ஆராய்ச்சியின் தலைப்பு : நீரிழிவு நோய் தொடர்பான தோல் நோயின் வெளிப்பாடுகள் குறித்த மருத்துவ மற்றும் திசுதுயரியல் ஆய்வு.

ஆய்வாளர் : மரு. ச.துர்காவதி

பங்கேற்பாளர் : வயது : பாலினம் :

ஆராய்ச்சி மையம் : தோல்நோய் துறை,
இராஜீவ் காந்தி அரசு பொது மருத்துவமனை, சென்னை.

இந்த ஆய்வில் பங்கேற்பதற்காக தாங்கள் அழைக்கப்படுகிறீர்கள். இந்த ஆவணத்தில் உள்ள தகவல்கள் தாங்கள் இந்த ஆய்வில் பங்கேற்க முடிவு செய்துக் கொள்ள உதவும். இதில் எதேனும் சந்தேகம் இருந்தால் வெளிப்படையாக கேள்விகளைக் கேட்டு தெரிந்துக் கொள்ளலாம்.

நாங்கள் இராஜீவ் காந்தி அரசு பொது மருத்துவமனையில் நீரிழிவு நோய் தொடர்பான தோல் நோயின் வெளிப்பாடுகள் குறித்த மருத்துவ மற்றும் திசுதுயரியல் ஆய்வை நடத்துகிறோம்.

அதற்கு உங்கள் பங்களிப்பு எங்களுக்கு பெரிதும் உதவக்கூடும்.

இந்த ஆய்வின் நோக்கம்:

இவ்வாராய்ச்சியில் தங்களிடையே அடிப்படை மற்றும் உங்களுடைய நோய் குறித்த விரிவான கேள்விகள் கேட்கப்படும். பின்னர் நீங்கள் மருத்துவப் பரிசோதனைக்கு உட்படுத்தப்படுவீர்கள். பின்பு தோல் சம்பந்தமான வெளிப்பாடுகள் குறித்து மருத்துவப் புகைப்படம் எடுக்கப்படும்.

அனைவரிடமும் இரத்தம் மாதிரி பெறப்பட்டு அது வழக்கமான இரத்தப் பரிசோதனைகளும் (CBC, LFT, RFT, Lipid Profile, FBS, PPBS) மற்றும் தேவைப்படுகின்ற நோயாளிகளுக்கு அவ்விடத்தில் இருந்து தோல் எடுக்கப்பட்டு திசுதுயரியல் பரிசோதனையும் செய்யப்படும்.

தங்களது மருத்துவ சிகிச்சை குறித்த தகவல்கள் இரகசியமாக பாதுகாக்கப்படும். ஆய்வின் போதோ அல்லது முடிவுகளை வெளியிடும் போதோ தங்களது பெயரையோ, அடையாளங்களையோ வெளியிடமாட்டோம் என்பதை தெரிவித்துக் கொள்கிறோம்.

இந்த ஆய்வில் பங்கேற்பது உங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆய்விலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம். இந்த ஆய்வில் பங்கேற்காவிட்டாலும் நீங்கள் வழக்கமான சிகிச்சையை தொடர்ந்து பெறலாம்.

இந்த ஆய்வின் முடிவு தங்களுக்கு ஆய்வின் இறுதியிலோ அல்லது ஆய்வின் போதோ தெரியப்படுத்தப்படும்.

ஆய்வாளர் கையொப்பம்

பங்கேற்பாளர் / பாதுகாவலர் கையொப்பம்

தேதி :

PATIENT CONSENT FORM

Title of the study: SKIN DISORDERS IN DIABETES MELLITUS – A CLINICOPATHOLOGICAL STUDY

Name of the Participant:

Name of the Principal investigator: Dr. C. Durgavathi

Name of the Institution : Rajiv Gandhi Government General Hospital, Chennai

Documentation of the informed consent

1. I _____ have read the information in this form (or it has been read for me). I was free to ask any questions and they have been answered. I am over 18 years of age and exercising my free power of choice, hereby give my consent to be included as a participant in the study.
2. I have read and understood this consent form and the information provided to me.
3. I have had the consent document explained to me.
4. I have been explained about the nature of the study.
5. I have been explained about my rights and responsibilities by the Investigator.
6. I am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my future treatment in this hospital
7. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities,govt. agencies and IEC.I understand that they are publicly published
8. I have understood that my identity will be kept confidential if my data are publicly presented.
9. I have had my questions answered to my satisfaction.
10. I have decided to be in the research study
11. I am aware that if I have any question during this study, I should contact at one of the addresses listed above. By signing this consent form I attest that the information given in this document has been clearly explained to me and apparently understood by me. I will be given a copy of this consent document.

Name and signature/thumb impression of the participant (or legal representative if participant incompetent)

_____	_____	_____
Name	Signature	Date

Name and Signature of the investigator or his representative obtaining consent:

_____	_____	_____
Name	Signature	Date

சுய ஒப்புதல் படிவம்

ஆராய்ச்சியின் தலைப்பு : நீரிழிவு நோய் தொடர்பான தோல் நோயின் வெளிப்பாடுகள் குறித்த மருத்துவ மற்றும் திசுதுயரியல் ஆய்வு.

பெயர் : வயது : தேதி : உள் / நோயாளி எண் :

..... என்பவராகிய நான் இந்த ஆய்வின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக அறிந்து கொண்டேன். எனது சந்தேகங்கள் அனைத்திற்கும் தகுந்த விளக்கம் அளிக்கப்பட்டது. இந்த ஆய்வில் முழு சுதந்திரத்துடன் மற்றும் சுயநினைவுடன் பங்கு கொள்ள சம்மதிக்கிறேன்.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்து கொண்டு நான் எனது சம்மதத்தைத் தெரிவிக்கிறேன். இச்சுய ஒப்புதல் படிவத்தை பற்றி எனக்கு விளக்கப்பட்டது.

இந்த ஆய்வினை பற்றிய அனைத்து தகவல்களும் எனக்கு தெரிவிக்கப்பட்டது. இந்த ஆய்வில் எனது உரிமை மற்றும் பங்கினை பற்றி அறிந்து கொண்டேன்.

இந்த ஆய்வில் பிறரின் நிர்பந்தமின்றி என் சொந்த விருப்பத்தின் பேரில்தான் பங்கு பெறுகிறேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின் வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்து கொண்டேன்.

இந்த ஆய்வில் கலந்து கொள்வதன் மூலம் என்னிடம் பெறப்படும் தகவலை ஆய்வாளர் இன்ஸ்டிட்யூசனல் எத்திக்ஸ் கமிட்டியினரிடமோ, அரசு நிறுவனத்திடமோ தேவைப்பட்டால் பகிர்ந்து கொள்ளலாம் என சம்மதிக்கிறேன்.

இந்த ஆய்வின் முடிவுகளை வெளியிடும்போது எனது பெயரோ, அடையாளமோ வெளியிடப்பட்டாது என அறிந்து கொண்டேன். இந்த ஆய்வின் விவரங்களைக் கொண்ட தகவல் தாளைப் பெற்று கொண்டேன். இந்த ஆய்விற்காக இரத்தப் பரிசோதனைகளும் (CBC, LFT, RFT, Lipid Profile, FBS, PPBS) மேலும் தேவைப்பட்டால் அவ்விடத்தில் இருந்து தோல் எடுக்கப்பட்டு திசுதுயரியல் பரிசோதனையும் செய்து கொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் பங்கேற்கும் பொழுது ஏதேனும் சந்தேகம் ஏற்பட்டால், உடனே ஆய்வாளரை தொடர்பு கொள்ள வேண்டும் என அறிந்து கொண்டேன்.

இச்சுய ஒப்புதல் படிவத்தில் கையெழுத்திடுவதன் மூலம் இதிலுள்ள அனைத்து விஷயங்களும் எனக்கு தெளிவாக விளக்கப்பட்டது என்றும் தெரிவிக்கிறேன் என்று புரிந்து கொண்டேன். இச்சுய ஒப்புதல் படிவத்தின் ஒரு நகல் எனக்கு கொடுக்கப்படும் என்றும் தெரிந்து கொண்டேன்.

பங்கேற்பாளர் / பாதுகாவலர் கையொப்பம் தேதி :

ஆய்வாளர் கையொப்பம் தேதி :

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301A
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To
Dr.C.Durgavathi
Post Graduate in MD DVL
Department of Dermatology
Madras Medical College
Chennai 600 003

Dear Dr.Mangala Adisesh,

The Institutional Ethics Committee has considered your request and approved your study titled **"SKIN DISORDERS IN DIABETES MELLITUS – A CLINICOPATHOLOGICAL STUDY" NO. 09122016.**

The following members of Ethics Committee were present in the meeting hold on **14.12.2016** conducted at Madras Medical College, Chennai 3

1.Dr.C.Rajendran, MD.,	:Chairperson
2.Dr.M.K.Muralidharan,MS.,M.Ch.,Dean, MMC,Ch-3	:Deputy Chairperson
3.Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3	: Member Secretary
4.Prof.B.Vasanthi,MD., Prof.of Pharmacology.,MMC,Ch-3	: Member
5.Prof.A.Rajendran,MS, Prof. of Surgery,MMC,Ch-3	: Member
6.Prof.N.Gopalakrishnan,MD,Director,Inst.of Nephrology,MMC,Ch	: Member
7.Prof.Baby Vasumathi,MD.,Director, Inst. of O & G	: Member
8.Prof.K.Ramadevi,MD.,Director,Inst.of Bio-Che,MMC,Ch-3	: Member
9.Prof.R.Padmavathy, MD, Director,Inst.of Pathology,MMC,Ch-3	: Member
10.Prof.S.Mayilvahanan,MD,Director, Inst. of Int.Med,MMC, Ch-3	: Member
11.Tmt.J.Rajalakshmi, JAO,MMC, Ch-3	: Lay Person
12.Thiru S.Govindasamy, BA.,BL,High Court,Chennai	: Lawyer
13.Tmt.Arnold Saulina, MA.,MSW.,	:Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

21.12

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

MASTER CHART

Type	S.No	AGE	SEX	DURATION	INFECTIONS						LEG ULCERS	NEUROPATHY	HYPERLIPIDEMIA RELATED			G	Stiffskin & Joints	Treatment related	Nail Changes	No. of Lesions	OTHERS	HISTOPATHOLOGY
					Candida	Derm	TV	ERYTHRASMA	FURUNCULOSIS	O.I			AN	ACROCHORDON	OTHERS							
T1DM	1	33	F	4 YEARS			No	No	No		No		No	No				No	No	1	V	
T1DM	2	30	M	5 YEARS	OT		No	No	No		No		No	No				No	No	2	AP	
T1DM	3	30	M	2 YEARS		TC	No	No	No		No	S	No	No				No	No	2		
T1DM	4	32	F	8 YEARS		TC	No	No	No	KP	No		Yes	Yes				No	No	2		Consistent with AN
T1DM	5	29	F	6 YEARS			No	No	No		No		No	No				No	No	1	V	
T1DM	6	27	M	4 YEARS	OT		No	No	No		No	A	No	No				No	No	2		
T1DM	7	31	F	2 YEARS		TP	No	No	No	KP	No		No	No				No	No	2	TP	
T1DM	8	24	M	3 YEARS		T.cru	Yes	No	No		No		No	Yes				No	No	2		
T1DM	9	16	M	6 MONTHS	I		No	No	No		No	S	No	No				No	No	2		
T1DM	10	28	M	3 YEARS		TC	No	No	No		No		No	No				lipoatrophy	No	2		
T1DM	11	31	F	2 YEARS			No	No	No		No	S	No	Yes				No	No	3	AP	
T1DM	12	26	M	4 YEARS	P		No	No	No		No		No	No		GA		keloid	No	3		Consistent with GA
T1DM	13	31	M	6 YEARS	OT		No	No	No		No	S	No	No				No	No	2		
T1DM	14	26	M	4 YEARS			Yes	No	No		Yes	S	No	No				No	No	3		
T1DM	15	22	M	3 YEARS	BP		No	No	No		No		No	No				No	No	2	V	
T1DM	16	28	M	6 MONTHS			Yes	No	No		No	S	No	No				No	No	2		
T1DM	17	27	M	2 YEARS		T.cru	Yes	No	No		No		No	Yes				No	No	3	AA	Consistent with Acrochordon
T1DM	18	30	F	6 YEARS			No	Yes	No		No		No	Yes				No	No	2		
T1DM	19	22	M	1 YEAR	BP		No	No	No		No	A	No	No				No	No	2		
T1DM	20	23	F	2 YEARS		TP	No	Yes	No		No		No	No				No	No	1		
T1DM	21	40	F	8 YEARS			Yes	No	No	HZ	No	A,S	No	No			CA	No	No	3		
T1DM	22	26	F	4 YEARS			No	No	No		No	S	No	Yes				No	No	2		Consistent with Acrochordon
T1DM	23	36	M	5 YEARS		TC	No	Yes	No		No		No	No				No	No	2	DB	
T1DM	24	24	M	8 MONTHS			Yes	No	No		No		Yes	Yes				No	No	2		
T1DM	25	32	F	8 YEARS	I		No	Yes	No		No		No	No				No	No	2	AP	
T1DM	26	16	M	1 YEAR	AC		No	No	No		No	A,S	No	No				No	No	2		
T1DM	27	26	F	5 YEARS			No	Yes	No		No	S	No	No				No	No	3	LP	
T1DM	28	27	M	6 YEARS	BP		No	No	No		Yes	S	No	No				No	No	3		
T1DM	29	22	M	1 YEAR			No	No	No		No		No	No				No	No	0		
T1DM	30	30	M	2 YEARS			Yes	No	No		No		No	No				No	No	2	TP	
T1DM	31	19	F	2 YEARS			No	No	No		No	S	No	No				No	No	2	V	
T1DM	32	26	M	4 YEARS			No	No	No		No		Yes	Yes				No	No	1		
T1DM	33	37	M	7 YEARS		T.cru	No	No	No		Yes		Yes	No				No	No	3		Consistent with AN
T1DM	34	18	F	1 YEAR			No	No	No		No	S	No	Yes				No	No	2		
T1DM	35	24	M	2 YEARS	BP		No	No	No		No	S	No	No				No	No	3	V	
T1DM	36	28	F	3 YEARS			No	No	Yes		No		No	No				No	No	1		
T1DM	37	34	F	6 YEARS	VVC		No	Yes	No		No	S	No	No				No	No	3	AP	
T1DM	38	24	M	2 YEARS			No	No	No		No	S	No	Yes				No	No	2		
T1DM	39	30	M	4 YEARS			No	No	Yes		No		No	No				No	No	1		
T1DM	40	34	M	3 YEARS			Yes	No	No		Yes	A,S	No	No				No	No	3		
T1DM	41	28	F	3 YEARS			No	No	No		No	S	No	Yes				No	No	2		
T1DM	42	18	M	1 YEAR	OT		No	No	Yes		No		No	No				No	No	1		Consistent with Acrochordon
T1DM	43	34	M	5 YEARS			No	Yes	No	C	No		No	No				No	No	1		

T1DM	44	30	F	3 YEARS			No	Yes	No		No	A	No	No				No	No	3	LP	
T1DM	45	34	M	6 YEARS			No	Yes	No		No	S	No	No				No	Beau line	3	NAIL(BEAU'S LINE)	
T1DM	46	18	F	1 YEAR			No	No	No		No	S	No	No				No	No	2	TP	
T1DM	47	18	M	1 YEAR	I		No	No	No		No		No	No				No	No	1		
T1DM	48	32	F	3 MONTHS			Yes	No	No		No		No	No				No	No	2	MA	
T1DM	49	21	M	1 YEAR	P		No	No	Yes		No		No	No				No	No	1		
T1DM	50	18	F	1 YEAR			No	No	No		No		No	No				lipoatrophy	No	1		
T1DM	51	35	F	1 YEAR			Yes	No	No		No	S	No	No				keloid	No	3	INSULIN INDUCED KELOID	
T1DM	52	18	F	2 MONTHS			Yes	No	No		No	S	No	No				No	No	3	V	
T1DM	53	33	F	3 YEARS			No	No	No		No		No	No				No	No	1	TP	
T1DM	54	22	F	4 MONTHS			Yes	Yes	No		No		No	No				No	No	2	V	
T1DM	55	27	F	2 YEARS			No	No	No		No		No	No				No	No	1	AP	
T2DM	56	55	F	10 YEARS	VVC		No	No	No		No		No	No				No	No	2	AP	
T2DM	57	72	M	6 YEARS		TC	No	No	No		No		No	No				No	No	1		
T2DM	58	32	F	6 MONTHS			No	Yes	No		No		No	No				No	No	1		
T2DM	59	54	F	4 YEARS	OT		No	No	No		No		No	No				No	No	2	TP	
T2DM	60	48	F	8 YEARS			No	No	No		No		No	No				No	No	1	TP	
T2DM	61	46	F	0	VVC		No	No	No		No		No	No				No	No	1		
T2DM	62	57	M	2 YEARS		TP	No	No	No		No		No	No				No	No	1		
T2DM	63	40	F	2 YEARS			No	Yes	No		No		No	No				No	No	1		
T2DM	64	54	F	6 YEARS			No	No	No		No		No	No				No	No	1	AP	
T2DM	65	54	M	1 YEAR			No	No	Yes		No		No	No				No	No	1		
T2DM	66	48	F	11 YEARS	I		No	No	No		No		No	No				No	No	1		
T2DM	67	52	F	7 YEARS	P		No	No	No		No		No	No				No	No	1		
T2DM	68	67	M	5 YEARS		TC	No	No	No		No		No	No				No	No	1		
T2DM	69	54	F	1 YEAR			No	Yes	No		No		No	No				No	No	2	TP	
T2DM	70	45	F	4 YEARS			No	No	No	KP	No		No	No				No	Beau line	2	NAIL(BEAU'S LINE)	
T2DM	71	47	F	3 YEARS			No	No	Yes		No	S	No	No				No	No	2		
T2DM	72	40	F	2 YEARS			No	No	Yes		No		Yes	Yes				No	No	2		Consistent with AN
T2DM	73	48	M	8 YEARS		T.cru	No	No	Yes		No		No	No				No	No	1		
T2DM	74	54	M	1 YEAR		TC	No	No	No		No		No	Yes				No	No	3	TP	
T2DM	75	54	F	8 YEARS	VVC		No	No	No		No		No	No				No	onychomadesis	2	NAIL(ONYCHOMADESIS)	
T2DM	76	65	F	12 YEARS			No	No	No		No		No	No				No	No	1	DB	Consistent with DB
T2DM	77	47	M	2 YEARS			No	No	No	KP	Yes		No	No				No	No	2		
T2DM	78	58	M	7 YEARS			No	No	No	M	No		No	No				No	No	1		Consistent with Mucor
T2DM	79	50	F	0	VVC		No	No	No		No		No	No				No	No	1		
T2DM	80	60	F	6 MONTHS	OT		No	No	No		No		No	No				No	No	1		
T2DM	81	60	M	6 YEARS		TP	No	No	No		No		No	No				No	No	2	AP	
T2DM	82	45	M	6 YEARS		TC	No	No	Yes		No		No	No				No	No	1		
T2DM	83	52	F	6 YEARS			No	No	Yes	C	No		No	No				No	No	2	TP	
T2DM	84	49	F	8 YEARS			No	No	No	HZ	No	S	No	No				No	No	2		
T2DM	85	48	F	6 YEARS			No	No	No		No		No	No				No	No	1	V	
T2DM	86	52	M	4 YEARS			No	No	No		No		No	No				No	No	1	LP	
T2DM	87	44	F	3 YEARS			No	No	No		No		No	No				No	No	1	V	
T2DM	88	49	M	8 YEARS		T.cru	No	No	No	E	Yes	S	No	No				No	No	3		
T2DM	89	50	M	7 YEARS		TP	No	No	No		No		No	No				No	No	1		
T2DM	90	53	F	9 YEARS			No	No	No	V	No		No	No				No	No	1		Consistent with Verruca
T2DM	91	58	M	10 YEARS		T.cru	No	No	No		No	M	No	No				No	No	2		
T2DM	92	62	F	10 YEARS			No	No	No		No	A	No	No				No	No	1		

T2DM	93	73	M	11 YEARS			No	No	No		Yes	S	No	No				No	No	3	DB	Consistent with DB
T2DM	94	48	F	6 YEARS			No	No	No		No		No	No				No	No	1	PM	
T2DM	95	53	M	12 YEARS			No	No	No	H/	No		No	No				No	No	1		
T2DM	96	64	F	4 YEARS	P		No	No	No		No		No	No				No	No	2	LA	
T2DM	97	55	F	1 YEAR	VVC		No	No	No		No		No	No				No	No	1		
T2DM	98	56	M	2 YEARS	BP		No	No	No		No		No	No				No	No	1		
T2DM	99	44	M	4 YEARS	BP		No	No	No		No		No	No				No	No	1		
T2DM	100	55	M	10 YEARS			No	No	No		Yes	S	No	No				No	No	3	AA	
T2DM	101	39	M	1 YEAR			No	No	No		No	S	No	No				No	No	2	LA	
T2DM	102	54	M	10 YEARS	BP		No	No	No		No	S	No	No				No	No	2		
T2DM	103	46	F	6 YEARS			No	No	No		No	A	No	No				No	No	1		
T2DM	104	50	F	9 YEARS			No	No	No		No	S	No	No				No	No	1		
T2DM	105	49	F	8 YEARS			No	No	No		No		Yes	Yes				No	No	1		
T2DM	106	56	F	9 YEARS	OT		No	No	No		No		No	No				No	No	1		
T2DM	107	64	F	13 YEARS	VVC		No	No	No		No		Yes	Yes				No	No	2		
T2DM	108	45	F	7 YEARS		T.cru	No	No	No		No		Yes	Yes				No	No	3	DD	Consistent with DD
T2DM	109	50	F	8 YEARS			No	No	No		No		No	No				No	No	0		
T2DM	110	43	F	3 YEARS			No	No	No		No	S	No	No				No	No	1		
T2DM	111	64	M	7 YEARS			No	No	No		No	A	No	No				No	No	2	CAN	
T2DM	112	44	M	3 YEARS			No	No	No		Yes		No	No				No	No	2	GANGRENE OF FOOT	
T2DM	113	43	M	6 YEARS			No	No	No		No	S	No	No				No	No	2	V	
T2DM	114	62	F	18 YEARS	VVC		No	No	No		No		No	No			S	No	No	2		
T2DM	115	49	F	5 YEARS			No	No	No		No		No	No				No	No	1	MA	
T2DM	116	44	F	4 YEARS			No	No	No		No		No	No				No	No	1	Ps	
T2DM	117	58	F	13 YEARS			No	No	No		Yes		No	No				No	No	2	AA	
T2DM	118	52	M	7 YEARS		TC	No	No	No		No		No	No	X			No	No	2		Consistent with Xanthelasma
T2DM	119	47	F	6 YEARS		TC	No	No	No		No		No	No				No	No	2	AP	
T2DM	120	66	M	10 YEARS	I	TC	No	No	No		No		No	Yes				No	No	2		
T2DM	121	56	M	11 YEARS	OT		No	No	No		No	S	No	No				No	No	2		
T2DM	122	50	M	4 YEARS			No	No	No		No	A	No	No				No	pterygium	2	NAIL PTERYGIUM	
T2DM	123	44	M	3 YEARS			No	No	No		No	S	No	No				No	No	2	V	
T2DM	124	70	F	6 YEARS			No	No	No		No		No	No				No	leukonychia	1	LEUKONYCHIA	
T2DM	125	68	F	17 YEARS			No	No	No		No		No	No				No	No	1	BP	
T2DM	126	54	M	4 YEARS			No	No	No		No		No	No				No	No	1	DB	Consistent with DB
T2DM	127	48	M	8 YEARS			No	No	No		No		No	No				No	leukonychia	1	NAIL(LEUKONYCHIA)	
T2DM	128	40	F	4 YEARS			No	No	No		No	S	No	No				No	No	1		
T2DM	129	49	F	9 YEARS			No	No	No		Yes	S	No	No				No	No	2		
T2DM	130	69	F	16 YEARS	VVC	TP	No	No	No		No		Yes	Yes				No	No	2		
T2DM	131	58	M	14 YEARS	P	TC	No	No	No		No	A	No	No				No	No	2		
T2DM	132	53	F	6 YEARS	VVC		No	No	No		No		No	No				No	No	1		
T2DM	133	52	F	4 YEARS			No	No	No		No	S	No	No				No	No	1		
T2DM	134	61	F	18 YEARS	VVC		No	No	No		No	S	No	No				No	Plate thickening	3	NAIL PLATE THICKENING	
T2DM	135	51	M	2 YEARS	OT		No	No	No		No		No	No				No	No	1		
T2DM	136	48	F	5 YEARS			No	No	No		No	S	Yes	Yes				No	No	2		
T2DM	137	54	F	9 YEARS		TC	No	No	No		No		Yes	No				No	No	2		
T2DM	138	68	F	14 YEARS		TP	No	No	Yes		No		No	No				No	No	1		
T2DM	139	62	F	10 YEARS	I		No	No	No		No		No	No				No	No	1		
T2DM	140	51	F	5 YEARS			No	No	No		No	A	No	No				No	No	1		
T2DM	141	54	F	8 YEARS		TP	No	No	No		No		No	Yes				No	No	2		
T2DM	142	53	F	13 YEARS		TC	No	No	No		No		No	No				No	No	1		
T2DM	143	65	F	20 YEARS	VVC		No	No	No	C	No		No	No			S	No	No	2		
T2DM	144	42	F	4 YEARS			Yes	No	No		No	S	No	No				No	No	2		
T2DM	145	48	F	0.	VVC		No	No	No		No		No	No				No	No	1		
T2DM	146	55	F	7 YEARS			No	No	No		No	S	No	Yes				No	No	2		
T2DM	147	47	M	8 YEARS	BP		No	No	No		No	S	No	No				No	No	2		

T2DM	148	53	M	3 YEARS	I		No	No	No		No		No	No				No	No	1		
T2DM	149	70	M	20 YEARS			No	No	No		No		No	No				No	pterygium	2	TP,PTERYGIUM	
T2DM	150	52	M	1 YEAR	I		No	No	No		No		No	No				No	No	1		
T2DM	151	60	M	2 YEARS	BP		No	No	No		No		No	No				No	No	1		
T2DM	152	45	F	7 YEARS			No	No	No		Yes	S	No	No		NLD		No	No	2		
T2DM	153	41	F	2 YEARS			Yes	No	No		No		No	Yes				No	No	2		
T2DM	154	58	M	4 YEARS	BP		No	No	No		No		No	No				No	No	2		
T2DM	155	52	F	9 YEARS			No	No	No		No	S	No	No				No	No	1		
T2DM	156	62	F	18 YEARS			No	No	No		No	S	No	No			CA	No	No	2		
T2DM	157	64	F	10 YEARS			No	No	No		No		No	No	X			No	No	1		Consistent with Xanthelasma
T2DM	158	44	M	1 YEAR	OT	T.cru	No	No	Yes		No		No	No				No	No	1		
T2DM	159	60	M	14 YEARS	BP	TC	No	No	No		No		No	No				No	No	1		
T2DM	160	54	F	7 YEARS			No	No	No		No		No	No		GA		No	No	1		
T2DM	161	47	M	6 YEARS	I	TC	No	No	No		No		No	No				No	No	1		
T2DM	162	44	M	0.	BP		No	No	No		No		No	No				No	No	1		
T2DM	163	48	M	6 MONTHS	I		No	No	No		No		No	No				No	No	1		
T2DM	164	53	F	7 YEARS			No	No	No		No		No	No				No	No	1	Ps	
T2DM	165	50	M	11 YEARS	OT		No	No	No		No		No	Yes				No	No	2		
T2DM	166	54	M	6 YEARS	BP		No	No	Yes		No		No	No				No	No	1		
T2DM	167	74	M	16 YEARS			No	No	No		No		No	No				No	No	1	Perf	Consistent with Perforating folliculitis
T2DM	168	50	F	4 YEARS			No	No	No		No		No	No	X			No	No	1		Consistent with Xanthelasma
T2DM	169	62	F	12 YEARS	VVC		No	No	No		No		No	No				No	No	2	Ps	
T2DM	170	50	F	10 YEARS	VVC		No	No	No		No		No	No				No	No	2	Ps	
T2DM	171	46	M	3 YEARS			No	Yes	No		No		No	No				No	No	2	Ps	Consistent with Scleredema
T2DM	172	62	M	10 YEARS		T.cru	No	No	No		No		No	No				No	No	2	TP	
T2DM	173	48	F	4 YEARS			No	No	No		No		No	No		GA		No	No	1		Consistent with GA
T2DM	174	56	M	8 YEARS			No	No	Yes		No		No	No				No	No	1		
T2DM	175	49	M	7 YEARS			No	No	Yes		No	S	No	No				No	No	2		
T2DM	176	56	F	4 YEARS			No	No	No		Yes		No	No				Photosensitivity	No	2	DRUG(PHOTOSENSITIVITY)	
T2DM	177	46	M	3 YEARS			Yes	No	No		No	S	No	No				No	leukonychia	3	LEUKONYCHIA	
T2DM	178	62	F	6 YEARS		T.cru	No	No	No		No		Yes	Yes				No	No	2		
T2DM	179	31	M	2 YEARS			No	No	No		No		No	No				No	No	1		
T2DM	180	50	M	4 YEARS		T.cru	No	Yes	No		No		No	No				No	No	2	TP	
T2DM	181	60	F	7 YEARS			No	No	No	C	No	S	No	No				No	No	2		
T2DM	182	40	M	1 YEAR			Yes	No	No		Yes	S	No	No				No	No	3		
T2DM	183	62	M	12 YEARS			No	No	Yes		No		No	No				No	No	2	CAN	
T2DM	184	35	M	4 MONTHS			Yes	No	No		No		No	No				No	No	1		
T2DM	185	32	F	1 YEAR			Yes	No	No		No		No	No				No	No	1		
T2DM	186	45	M	7 YEARS			No	No	No	C	No		No	No				No	No	1		
T2DM	187	48	F	9 YEARS			No	No	Yes		No	A	No	No				No	No	2		
T2DM	188	70	F	15 YEARS		TC	No	No	No		No		Yes	Yes				No	No	2		
T2DM	189	49	M	10 YEARS			No	No	Yes		No	S	No	No				No	No	2		
T2DM	190	48	M	8 YEARS			No	No	Yes		No	S	No	No				No	No	2		
T2DM	191	52	F	6 YEARS			No	No	Yes		No		No	No				FDE	No	2		
T2DM	192	35	F	7 MONTHS			Yes	No	No		No		No	No				No	No	1		
T2DM	193	42	M	5 YEARS			Yes	No	No		No	S	No	No				No	No	2		
T2DM	194	36	M	3 YEARS			Yes	No	No		No		No	No				No	No	1		
T2DM	195	54	M	6 YEARS			No	No	No	C	No		No	No				No	No	2	Ps	
T2DM	196	45	M	6 YEARS			Yes	No	No		No	S	No	No				No	No	2		
T2DM	197	42	M	9 MONTHS			Yes	No	Yes	E	No		No	No				No	No	1		
T2DM	198	60	F	8 YEARS	I		No	No	No		No	A,S	No	No				No	No	2		
T2DM	199	48	M	7 YEARS		TC	No	No	No		No	S	No	No				No	No	2		
T2DM	200	61	F	8 YEARS			Yes	No	No		No		No	No				No	No	1		

Key for Master Chart

TIDM - Type 1 Diabetes mellitus

TIDM - Type 2 Diabetes Mellitus

1. Sex

M - Male

F - Female

2. INFECTIONS

OT - ORAL THRUSH

P - PARONYCHIA

I - INTERTRIGO

BP - BALANO POSTHITIS

AC - ANGULAR CHELITIS

VVC - VULVO VAGINAL CANDIDIASIS

TC - TINEA CORPORIS

TP - TINEA PEDIS

T.cru - TINEA CRURIS

TV - TINEA VERSICOLOR

OI - OTHER INFECTIONS

KP - KERATOLYSIS PUNCTATA

VZ - VARICELLA ZOSTER

C - CELLULITIS

E - ERYSIPELAS

V - VERUCCA

M - MUCOR MYCOSIS

3. NEUROPATHY

S - SENSORY

A - AUTONOMIC

4. HYPERLIPIDEMIA RELATED

AN - ACANTHOSIS NIGRICANS

X - XANTHELASMA

5. GRANULOMATDUS DISORDERS

GA - GRANULOMA ANNULARE

NLD - NECROBIOSIS LIPOIDICA

6. STIFF SKIN, JOINTS

CA - CHEIROARTHROPATHY

S - SCLEREDEMA DIABETICORUM

7. NAIL

B - BEAU'S LINE

O - ONYCHOMADESIS

P - PTERYGIUM

L - LEUKONYCHIA

T - NAIL PLATE THICKENING

8. TREATMENT RELATED

K - KELOID

L - LIPODYSTROPHY

FDE - FIXED DRUG ERUPTION

PS - PHOTOSENSITIVITY

9. ASSOCIATED DERMATOSIS

TP - TRUNKAL PRURITUS

AP - ANOGENITAL PRURITUS

DD - DIABETIC DERMOPATHY

DB - DIABETIC BULLAE

G - GANGRENE OF FOOT

V - VITILIGO

AA - ALOPECIA AREATA

PM - PRETIBIAL MYXEDEMA

MA/LA - MACULAR/LICHEN AMYLOIDOSIS

CAN - CHERRY ANGIOMA

Ps - PSORIASIS

BP - BULLOUS PEMPHIGOLD

Perf - PERFORATING FOLLICULITIS